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AN EXPERIMENTAL ANALYSIS OF THE PROCESS OF RECOGNIZING¹

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¹ From the Psychological Laboratory of Clark University.

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I. INTRODUCTORY

This study is concerned with an analysis and description of the process of recognizing. When the preliminary work was begun, the question in the investigator's mind was this: What is the content of the cognitive consciousness? As the investigation proceeded and it became amply evident that the content of the cognitive process, instead of being unique and constant in its character, may vary widely both qualitatively and quantitatively, the problems formulated themselves as follows: What are the mental components which may function as the content of an act of recognition? What is the nature of the functioning of such contents, *i. e.*, in what order do they appear? Is the awareness of familiarity influenced by the relative intensity and duration of different mental events composing the content of the act of recognizing? Is there a difference in the nature of the content, or of its functioning or of both, in the recognizing of relatively novel and of exceedingly familiar stimuli? What is the essential characteristic which gives to the consciousness of familiarity its unique and proper flavor? These are the problems which this investigation was finally designed to attack.

It is a pleasure to acknowledge my debt both to Professor J. W. Baird, who suggested this problem and who has given generously of his time as adviser and as observer, and to the other observers, upon whose faithful work this study is based.

II. HISTORICAL

The experimental history of the analysis of the process of recognizing may be said to begin with the Lehmann-Höffding controversy² which was opened in 1889 by an article in which Lehmann (25) maintained that recognition is due to association by contiguity. He pointed out that every perception is attended by a number of associated images, and he held that when a given perception is re-experienced, the images formerly associated with it are incited to arousal, the result of such incitement being the experience of familiarity. Lehmann (25 and 26) offered evidence which, he believed, supported this view. He asked seven observers to report whether or not a given odor was known to them, and then to give an account of all the images which were present to consciousness after the presentation of the stimulus. In his four hundred and twenty-eight cases he obtained 84.7 per cent. of recognitions, and 27.6 per cent. of these recognitions were attended by images of the names of the stimuli; 44.9 per cent. were attended by other instantaneously reproduced

² E. H. Weber's experiment with visual lengths and weights (*Der Tastsinn und das Gemeingefühl*, 1851) was not concerned with the nature of the process of recognizing.

images; 5.2 per cent. by images subsequently appearing, and 7 per cent. by no images whatsoever. Lehmann explained the latter cases on the supposition that images had appeared but in such dim and transitory form that they escaped the attention of the observer. Furthermore, he maintained that it was the inciting of associated images, rather than their actual appearance, which gave the characteristic quality of 'known' to any stimulus.

Höffding (35) granted that associations are frequently present in the recognition of objects, but he denied that they are essential to the act of recognizing, for example, to the immediate recognition of a very familiar object. He asserted, on the contrary, that the perception of familiar objects is qualitatively different from the perception of novel objects; and the quality which is immediately present in the former case, he calls the *Bekanntheitsqualität*. This quality of 'known,' Höffding believes to be due to a fusion of the perception with an immediately aroused image of itself,—the fusion differing from an association in that a unitary experience results. This *Bekanntheitsqualität* is to be referred to a physiological basis,—an increased facility of nerve functioning.

Lehmann denies the existence of Höffding's 'immediate' recognition, basing his case on a series of experiments in which he employed different shades of gray. His procedure consisted in displaying a gray momentarily and after a short interval in displaying another. He then asked the observer to determine whether the second gray was or was not identical with the first, and to give an account of the ideas and other contents which had attended his determination. Again, Lehmann found no case of recognition which he believed to be devoid of reproduced images; and again he urges that the inciting of associated images constitutes the essence of recognition.

Höffding (36) answers this article by maintaining that 1. Lehmann's exposures were made at such short intervals that the 'disposition' set up by the exposure of one gray, if not the image itself, must still be functioning at the time of the second exposure; and 2. the artificial conditions of the laboratory render the normal cognitive process impossible.

Bentley (42) attempted to determine the status of the image in the functioning of memory. In extended experiments upon visual imagery, he collected evidence which strongly indicates that assured and correct recognitions frequently occur in cases where no image is present. Whipple (23) reached the same conclusion as a result of experiments with clangs and tones.

In Gamble and Calkins' (65) repetition of Lehmann's experiments with odors, they found a lesser percentage of recognitions without reproduced images and a greater percentage of recognitions which were attended by reproduced images than Lehmann had reported, but they conclude that reproduction is not necessary to the process of recognition. Their conclusion is based on the following facts: 1. correct reproductions are very often present in cases of non-recognition; 2. associations which were clear enough to be reproduced were not always present in cases where recognition occurred; 3. in cases where the order was noted, the attendant associations were usually reported as appearing after the recognition.

Severance and Washburn (69) instructed a number of observers to gaze steadily at various familiar words of six letters, and they found that the words soon began to lose all associative power, and hence became meaningless. A little later, they ceased to look familiar, and

finally, even the letters themselves were meaningless marks, conveying no sense of familiarity. The authors conclude that this loss of associative power and finally of all familiarity was due to the induction of abnormal sequences of the processes attended to.

Dearborn (17) employed ink blots as experimental material in an attempt to analyze the awareness of similarity and dissimilarity. One ink blot was selected as a norm, and placed in a frame convenient to the observer's eye. One hundred other blots were then presented simultaneously, the observer being asked to choose the ten which were most like, or most unlike, the norm. After the choice was completed, the observer described how the norm was apperceived and what was its most essential characteristic. The results show the significance of language in the observer's procedure,—criteria of likeness or difference being almost always sharply defined in words. Dearborn concludes that 'feeling' criteria (feelings of likeness or unlikeness) are more accurate than 'conceptual criteria,'—the observer whom he considered most successful having reported such 'feelings.' Dearborn refers feeling of familiarity to ease of following old cerebral paths, and feelings of unfamiliarity to a 'fumbling among the infinite possibilities of cortical routes.'

Using the method of partially learning nonsense syllables, Meumann (21) asked his observers to state, after each reading, whether or not the syllable just read was recognized as having been seen before. A new syllable was occasionally inserted in the list, as a control. Meumann finds that the impression of 'unknown' is a much more positive and definite experience than is the impression of 'known.' Five factors conduce to this: the sensation of hesitation, shock or weak fright; the interruption of ideation; the consciousness of void or emptiness; the characteristic feeling of unpleasantness; the non-appearance of the usual ideation. The 'feeling of familiarity,' on the other hand, he holds to be a product of: the facilitation of perception; accompanying feelings and organic sensations, carrying pleasantness and relaxed tension; less strained attention; the reproduction of ideas, often dim and scarcely discoverable.

Heine (66) undertook to determine whether subsequent disturbances have a retroactive effect upon recognition as they have been shown to have upon recall. Her method consisted in having her observers learn parallel series of nonsense syllables or four-place numbers, and then she introduced a disturbance by presenting, immediately after the learning, other materials (pictures, numbers, syllables) which were later to be described or reproduced. The recognition-time and the amount recognized both indicate that no retroactive effect took place. Similar experiments dealing with recall, instead of recognition, show the presence of a considerable retroactive disturbance. From these findings, Heine concludes that the factors involved in recall are fundamentally different from those involved in recognition, and that recognition is not dependent upon associative processes.

Meyer (68) set out to ascertain whether 'preparedness' favors the process of recognition as it does the process of reproduction. His method consisted in measuring the relative time and number of correct judgments of 'new' or 'old' when nonsense syllables which had previously been learned were presented in four different ways: an 'old' syllable preceded by its immediate antecedent in the learning series; an 'old' syllable presented alone; a 'new' syllable preceded by an accented syllable of a learned series; a 'new' syllable presented alone. His results show that those syllables which were preceded

by a 'preparing' syllable derive an advantage from that fact. The effect of this 'preparedness' for recognizing in consequence of the presenting of another associated syllable persists through a long expectation period even when other disconnected material intervenes. Meyer interprets the longer reaction-time and the lesser certainty in the case of unfamiliarity as an indication that the consciousness of 'unknown' is merely the absence of the quality of 'known'; and he quotes Meumann (21, p. 39) in support of this position. But instead of regarding unfamiliarity as a negative quality, Meumann holds that the quality of unknown possesses a much more definite character than the quality of known, and he even specifies its characteristics in detail (21, p. 38 ff.).

III. EXPERIMENTAL

A. PRELIMINARY

1. Repetition of Katzaroff's experiments.—As a preliminary to our investigation, we undertook to repeat the work of Katzaroff. Our method was an exact duplicate of his; but we employed only thirty-six of his seventy-two drawings. Our experiment, therefore, while less extensive than his, was identical with it in the details of each sitting. Our observers included four men and four women, all of whom had had laboratory training in psychology; two were special students, and three were instructors in the department of experimental psychology.

Eighteen drawings were presented at each sitting, in groups of six, each drawing being exposed in a tachistoscope for six seconds, with an interval of four seconds between exposures. An interval of five minutes elapsed after the first and again after the second group of six. The observer was instructed to note each design carefully in order that he might be able to identify it later. He was told that after the series had been exposed, he would be shown these same drawings again, together with eighteen other very similar drawings, distributed irregularly among them. His task was to consist in determining whether the drawing presented in this subsequent series was identical with one seen in the first series, whether it was similar but not identical, or whether it was wholly new; and he was asked to distinguish four degrees of certainty of judgment,—absolutely sure, fairly sure, sure, and doubtful. Immediately after his judgment of each drawing of the recognition series, he dictated a detailed introspection to a stenographer, who was screened from view. The results of these experiments corroborated Katzaroff's findings in certain particulars, but they contradicted Katzaroff's findings in other particulars.

First, as to the rôle of the image in the act of recognizing: Katzaroff is convinced that imagery is not essential; he maintains that recognition has two distinct stages: first, the appearance of a feeling of familiarity; second, the appearance of images and memories. And he finds that the first of these is the initial process in every act of recognizing, while the imagery functions merely in a corroborative fashion. In an overwhelming majority of cases, our observers analyzed their cognitive consciousness into imagery and kinaesthesia, with occasional affective toning. However, cases in which a feeling of familiarity or of strangeness seemed immediate and unanalyzable were reported in a few instances by our observers. These unanalyzed

attitudes occurred most frequently in those cases where, as a variant of Katzaroff's procedure, we gave our observers a repetition of the same series at a later date. This finding suggested that the function of imagery may now have become less prominent because the material had become more familiar; and we made use of this suggestion in planning our next series of experiments.

Second, Katzaroff finds that the time required for making a judgment regarding designs which had already been presented but which had been forgotten, is greater than that required for similar designs which had not previously been seen; and he finds in this phenomenon a warrant for assuming that subconscious processes are in action here,—the material not being wholly strange in the former case. We have failed to confirm this difference in time; and we can see no justification for Katzaroff's appeal to that convenient hypothesis, the subconscious.

Third, in one other respect our results seem to warrant a rejection of Katzaroff's conclusions. He finds that recognition is essentially an affective process, and he believes that it is always enveloped in a consciousness of self. Our introspections fail to confirm this finding; in many instances, no trace of affection is to be found, and consciousness of self appears still more rarely.

In brief, we corroborated Katzaroff's findings in the following particulars: *a.* Imagery is lacking in many introspective descriptions of recognition; but we are not prepared to assert that imagery is never, or even that it is seldom essential to the cognitive consciousness. These preliminary experiments indicated that this consciousness has several, perhaps multitudinous stages, and that imagery plays a somewhat different rôle in each. *b.* The act of recognizing is frequently characterized by a conscious comparison of image and percept; this is especially true of the recognition of relatively novel objects. *c.* There is no correlation between subjective certainty and objective correctness.

We failed to corroborate Katzaroff's findings in the following particulars: *a.* The initial stage of every act of recognizing consists in the appearance of a 'feeling of familiarity'; and imagery serves only the secondary function of confirming or correcting this primary act of immediate recognition. *b.* Recognition is always an affective rather than an intellectual process, and it inevitably involves a consciousness of self.

2. Preliminary experiments with photographs of persons and places, advertisements, block letters, different faces of types.—For a second series of preliminary experiments we selected materials which, we hoped, our observers would find to possess widely different degrees of familiarity. We secured postcard views from the home cities, colleges, etc., of each of our eight observers, and among these familiar pictures we distributed views of Worcester, of Clark University, and others more or less familiar or wholly unknown; we also employed a series of Perry pictures of prominent men and women, and a group of more or less familiar advertisements. The eight observers who served on the previous problem served in these experiments also. Two methods of visual presentation were employed: First, the picture was either seen through an aperture giving a rapidly recurring series of instantaneous exposures in a rotating disc, or it was exposed by means of a mechanism which provided a continuous exposure but at a variable distance from the observer. The arrangement was

such that the picture could be presented at a distance where its details were imperceptible; then, while the picture was brought progressively nearer and nearer to the observer's eye, in continuous exposure, the details gradually emerged and became clear. The object in both these methods of presentation was to build up a process of recognition by gradual increments, so that the observer might be enabled to examine and give an account of its genesis and development.

Another series was designed to analyze the act of recognizing a tactual stimulus. Here we employed wooden blocks upon whose faces were cut letters of the alphabet, and digits, averaging eight centimeters in height; this series also included various objects such as a watch, a pipette, a small bronze medal, etc. The observer was blindfolded and the object to be recognized was placed in his hand. He immediately dictated a report of what went on in consciousness. If he failed to recognize the object he explored it still further, and then gave an account of the mental processes involved in his final attempt to identify it.

Data in all four of these series indicated that imagery played a very important rôle, and that it was supplemented by organic sensations and kinaesthesia. Imagery was the first and only content reported in the majority of cases. Affective toning was rarely reported, as also was consciousness of self. It was found that the observers usually adopted a procedure which consisted in reconstructing the situation in which the stimulus-object had formerly or usually been experienced in everyday life; this act of reconstructive recognition was usually characterized by a mass of imagery, sometimes detailed but often sketchy, in which the visual and the motor modalities predominated.

The results of these experiments indicate that imagery is of extremely variable significance in the act of recognizing. In certain instances, our observers reported a profusion of images which were vivid and rich in detail; in other instances their imagery was scant, indefinite, and schematic. Numerous introspections indicate that an inverse relationship obtains between abundance and richness of imagery on the one hand, and facility of recognizing on the other hand. In cases where the object or picture was relatively unfamiliar, and where the act of recognizing it was hesitant and difficult, the imagery was abundant and rich in detail. The discovery of this state of affairs suggested a method which promised to furnish a more detailed analysis of the cognitive consciousness, and a clearer insight into the component processes which contribute to the act of recognizing. And in all of our subsequent experiments we adopted a procedure which consisted in presenting materials which were unfamiliar at the outset, and in re-presenting them at intervals until they were recognized without difficulty. It was hoped that the introspective reports of these successive acts of recognizing stimuli, which must of necessity grow more and more familiar, would constitute essentially a series of cross-sections through the cognitive consciousness at successive points between its initial, hesitant stage, and its final, facile and mechanized stage.

In a final series of preliminary experiments, the materials chosen were alphabets printed from five different faces of type, each representing a characteristic variant from the common letter-form. These variant letter-forms were wholly unfamiliar to the observers at the outset; and the experiment consisted in having him describe the mental contents and the mental procedures employed in successive

acts of recognition at various stages throughout the process of learning. The lower-case alphabets were arranged in vertical columns, side by side, on a strip of white paper 6 cm. wide. This strip was placed on the drum of a Spindler and Hoyer exposure-apparatus, and the mechanism timed to furnish a three-seconds' exposure. The name of each face of type was plainly printed on the bevel of the exposure aperture, so that it would appear just below the column to which it belonged.

Six observers took part in this experiment. All had had training in introspection, and four of the six were specially trained students and investigators in experimental psychology. The experiments were begun April 3, 1912, and concluded June 6, 1912.

The observer was instructed to note the letters as they appeared (the row of five different "a's," then the "b's," etc.), in any fashion he chose, endeavoring to learn the characteristics of the different faces. After the exposure of the entire series, the observer was shown isolated letters from the list; he was asked to name the type to which each isolated letter belonged, and then to give a detailed description of the processes involved in his recognition, or attempted recognition. The observer was given his own time in the test series, the experimenter noting by means of a stop-watch the number of seconds required in each case. The sittings usually required from thirty minutes to an hour, though rarely the latter, so the element of fatigue was a negligible factor; the sittings were continued until the observer succeeded in recognizing immediately the 'face' to which each letter belonged.

The significant fact shown by these experiments is the marked decrease in the amount, variety, and clearness of imagery present in the recognitions as the letter-forms became more and more familiar to the observer. Many other points of interest appear in the results of these experiments,—some confirming beliefs widely held, some contradicting the results of other investigators in this field. Our data show that: 1. The time required for the act of recognizing decreases as the object becomes more familiar; 2. the degree of subjective certainty and the proportion of correct recognitions increase as the object becomes more familiar; 3. affective toning is wholly absent in the great majority of cognitive experiences; 4. no consciousness of self is present in the act of recognizing save in rare and exceptional instances; 5. the 'feeling of familiarity' rarely, if ever, appears as an unanalyzable and *sui generis* experience; 6. experiences of a motor sort become more and more dominant in proportion as the act of recognizing becomes more facile and more certain.

As the data accumulated, we discovered a serious defect in our method of presenting this series. By arranging all five alphabets side by side and exposing the letters in rows (all the "a's" in one row, all the "b's" in the next, etc.), we had put a premium on the spatial localization factor of memory; and our introspections showed that our observers tended to identify any given letter by referring it directly to the position in the row (first, second, third, fourth or fifth) which it had occupied during the exposure of the series. We believed this might account for the predominance of kinaesthesia in the recognitions of our observers (eye-movements, imaged or inner-vated, having been frequently reported), as well as for visual schemas which were common. We corrected this defect of method in the visual series of the final experiments.

B. FINAL EXPERIMENTS

A. The preliminary experiments had shown that there is great diversity in the mental experiences which are known by the name of recognition. They had made it clear that it is not sufficient to mark off two great types of this process and to call *immediate* or *direct* that recognition which follows immediately upon perception,—where a given stimulus seems familiar the moment it is perceived, with apparently no intervening process whatever,—and *mediate* or *indirect*, that recognition in which associations appear in consciousness before or simultaneously with the consciousness of familiarity. Our introspective accounts had indicated not only that extreme cases of incipient and complete familiarity are characterized by more marked differences in the contents of consciousness than has usually been supposed, but also that there are several, perhaps many, intermediate stages between these two extremes.

We undertook to investigate these intermediate stages, as well as the two extremes; and in order to have a means of measuring and comparing them in the course of their development we devised a genetic method. We chose materials which were novel and taught them to our observers, taking an introspective cross-section of the recognitive consciousness at numerous levels between the initial and the mechanized stages.³ The problem was attacked in four sense departments,—visual, auditory, tactual, and olfactory.

A. Method and Material Employed in Experiments in the Recognition of Visual Stimuli.

The materials chosen for this experiment were five different faces of type,—Della Robbia, Bulfinch, American Typewriter, Clearface, and DeVinne. The capital letters of a given face were arranged vertically, in alphabetical order, on a band of paper designed for exposure on the drum of a Spindler and Hoyer exposure apparatus,—a device which gives a series of exposures, each of which is made during a pause in the movement of the revolving drum. The printed name of the type was placed just above the exposure apparatus. The exposure-time allowed to each letter was four-tenths of a second. The observer was seated before the apparatus, and was told that he was to observe the letters with the purpose of being able, eventually, to recognize any one of them as belonging to a particular face of type. He was told, further, that he was not to feel constrained to learn these types at one, two or half a dozen sittings; he was made to understand that the experimenter was not interested in the quantitative results, but rather in the introspective accounts of what goes on in mind when a given visual stimulus is recognized as familiar. The name of the type was pronounced to the observer, then the 'ready' signal given, the apparatus set in motion, and the shutter

³ We shall use the term 'initial recognitions' to designate the first or earliest of our observers' identifications of the material learned,—those recognitions in which there was usually only a slight degree of familiarity. The name 'final recognitions' will be given to those later experiences in which the observers' familiarity with the stimuli was complete, but in which it was still a conscious content. This study is not concerned with mechanized experiences which are practically reflex reactions to stimuli, and in which no consciousness of familiarity is present.

opened. The entire alphabet was displayed from beginning to end. At the close of the exposure, the observer gave an introspective account of his procedure, which was taken down by a stenographer. In this manner, all five of the faces of type were displayed in turn, but in different order, at each sitting.

At the beginning of the second and of each subsequent sitting, tests were made of the observer's familiarity with the types in the following manner. Single letters of the various types, printed on cards, were exposed in exactly the same position as that occupied by the letters in the learning series. The observer was asked to report, as soon as he could, whether or not he recognized the face to which the letter belonged, and to give an account of everything which was present to consciousness from his perception of the stimulus until his recognition was reported, the time required for the recognition being recorded by means of a stop-watch. The observations were made once each week, from March 3, 1913, to May 12, 1913.

Four observers served in this experiment, all students or instructors in the department of psychology in the University. They were: *F.*, instructor in the department of experimental psychology; *Fn.*, laboratory assistant and fourth year graduate student in experimental psychology; *Fs.*, fourth year graduate student in experimental psychology; *W.*, first year graduate student in experimental psychology. The observers did not discuss the problem either with each other, or with the experimenter.

B. Method and Materials Employed in Experiments in the Recognition of Auditory Stimuli

The material chosen for this part of the experiment comprised various airs and themes from operas, symphonies, songs, etc. Care was taken to select for each observer only such compositions as were entirely unfamiliar to him when the experiment began. The following is a list of the selections employed, either as a whole or in part: *Tschaiikowsky*, Danse Trepak, Overture 1812, Song without Words, Sleeping Beauty Ballet, Fifth Symphony; *Reissiger*, Yelva Overture; *Humperdinck*, Hansel and Gretel; *Verdi*, Rigoletto, Il Trovatore and La Traviata; *Leybach*, Fifth Nocturne; *Tobani*, Songe d'Automne, Hungarian Fantasia; *Goldmark*, Brautlied. The selections chosen were all orchestral, in order that, so far as possible, the recognitions should have to do with the air alone.

The music was played on a Victor Talking Machine, placed in a box in a room adjoining the experimenting room. The sound was conveyed to the observers' ears through the wall by means of a rubber tube which terminated in a pair of stethoscopic ear-tubes. A stop-cock in the tube, between the phonograph and the wall, enabled the experimenter to control the part and amount of the selection which was presented to the observer.

The observer sat in a comfortable chair, having on its right side a broad arm to which was screwed a reaction-key communicating with another key placed on the phonograph box. He was instructed to give one tap on the reaction-key when the music became familiar, and two or more taps when he could identify the selection. When this latter signal was given, the music was instantly shut off; and the experimenter recorded the observer's introspective report of his mental processes from his perception of the ready signal to the appearance of his recognition of the selection.

At the first sitting, from three to seven airs were presented to the observer, the name of each being given him in both visual and auditory fashion. At the close of the selection, the observer gave a detailed account of his procedure throughout. This was done after each act of learning as well as after each test of recognition. At later sittings, besides a new air or two, the selections already played to the observer were given him again and if he failed to recognize them, the experimenter named them and played them through once more. The time required for each recognition was recorded by means of a stop-watch. Occasionally an entirely new air was played and this check brought out some very interesting experiences of non-recognition which will be discussed later.

This series of experiments was begun in November, 1912, and continued with each observer until the recognition of most of the selections had become immediate. The last sitting took place February 19, 1913. Six observers took part in these experiments,—all students or instructors in the psychological department of the University. They were *F.*, *Fs.*, *W.*, and *Fn.*, who assisted in the visual series already described, and *V.* and *B.*, third year graduate students in psychology.

C. Method and Material Employed in Experiments in the Recognition of Tactual Stimuli

The method employed in this series of experiments was essentially the same as that used in the visual and auditory series. Our observers were taught to recognize tactual stimuli which had been wholly novel and unfamiliar at the outset; and introspective cross-sections were taken throughout the course of the mechanization of their acts of recognizing these stimuli.

The materials employed were the letters of the alphabet for the blind (New York Point). In the learning series, the blindfolded observer sat in the ordinary writing position, with his right arm resting upon a frame within which the letters were presented. He was instructed to explore with his finger-tip each tactual stimulus which would be presented, and to learn to recognize these stimuli when they should subsequently be given to him. A sheet containing a single letter was then placed in the frame; and at a given signal, the observer began his exploration, the experimenter pronouncing the name of the letter. Thirty seconds were allowed for each exploration in the learning series; and the observer gave an introspective account of his procedure at the expiration of that time. Not more than five new letters were presented at a single sitting.

In the recognition series, the observer was asked to explore the stimulus and to report whether or not it was familiar; in the case of a familiar stimulus, he was instructed to recall the name if possible. The time required for the act of recognition was noted in each case, and a stenographer recorded the observer's introspective report of his procedure. When he failed to recognize a letter, or when he made a false recognition, he was asked to explore the same stimulus again and the correct name was supplied by the experimenter. This procedure was continued until the recognitions were made without hesitation. Five of our observers: *F.*, *Fn.*, *Fs.*, *V.*, and *W.* took part in this series of experiments. The observations began October 31, 1912, and closed February 24, 1913.

D. Method and Materials Employed in Experiments in the Recognition of Olfactory Stimuli

In a fourth series of experiments, observers were taught to recognize a number of different odors, including: (1) Novel perfumes,—*Quelques Fleurs*, *Acme Violet*, *Coast Violet*, *Trefle*, *Halcyon Rose*, *Sous Bois*, *Bouquet Janice*, *Bruyère Rêve*, and *Flowers of Savoy*; (2) a series of alcohols,—*Ethyl*, *Methyl*, *Amyl* and *Butyl*; several coal tar products,—*Cresol*, *Phenol*. Other odors were often used as controls.

These substances were kept in bottles of uniform size, and they were handed to the blindfolded observer, who removed the stopper and sniffed the odor in the manner that seemed most natural and convenient to him. In the learning series, which never exceeded eight in number, he was told the name of the odor, and allowed to investigate the smell quality as long as he wished. As he dictated an introspective account after each experience, the olfactory membrane had ample time to recover between stimulations. The interim always exceeded the time found by Zwaardemaker⁴ to be necessary for recovery from complete fatigue of the membrane,—a condition which occurred in one case only during the entire experiment.

In the test series, the observer was given various of the bottles, one at time, and asked to identify each odor if he could. He was allowed to signify his recognition by handing back the bottle, giving the odor's name, or in any way that he chose. In each experience, the time consumed from the presentation of the stimulus (the actual sniffing of the odor) to the observer's reaction signal was recorded and his introspection was taken down by a stenographer.

Seven observers took part in this experiment: *F.*, *Fs.*, *W.*, *V.*, *S.*, *O.*, and *Bd.* The last three served only in the olfactory series. *O.* and *S.* were graduate students in psychology, *Bd.* is Professor of Psychology and head of the Department of Experimental Psychology.

2. RESULTS

A. Introspections.—In this section we present typical introspections obtained from each observer in each series of these experiments.

Observer F.

Introspections on the Recognizing of Visual Stimuli

1.⁵ April 2, 1913. Clearface 'A,' 10 sec. (8th. presentation; first correct recognition.) "As soon as I saw the letter I was conscious of a vocal-motor image 'big, thick,—what is that thing?' There was a decided bodily strain, rather widely diffused; I repeated 'big, thick,' over and over, in vocal-motor imagery, until suddenly 'big, thick Clearface' rushed into consciousness in vocal-motor and auditory terms, the accent on the 'Clearface' expressing my annoyance at being so slow. I tapped the key at that point."

2. April 16, 1913. Clearface 'A,' 7 sec. (9th. presentation.) "On perceiving the stimulus I found myself repeating 'big, thick' in vocal-motor auditory imagery. It was very familiar. I went through the

⁴ H. Zwaardemaker, *Die Physiologie des Geruchs*. Leipzig, 1895.

⁵ The serial number at the beginning of the introspection, to the left of the date, is a purely arbitrary number which is inserted here for convenience in subsequent reference.

list of types in this manner, in vocal-motor auditory imagery: 'big, thick Della Robbia; big, thick De Vinne; big, thick American Type-writer; big, thick Clearface.' Then I repeated this last phrase quickly and with assurance. There was increasing tension throughout these processes, with relaxation of strain at the last, as soon as I tapped the key."

3. April 24, 1913. Clearface 'A,' 1 sec. (10th, presentation.) "As I became aware of the visual stimulus, I had, in vocal-motor auditory imagery, 'big, thick Clearface,' with relaxation of tension and absolute surety."

4. April 30, 1913. Clearface 'A,' 6 sec. (11th. and last presentation.) "On perceiving the letter I was conscious of immediately tapping and saying 'Clearface.'"

The Recognizing of Auditory Stimuli

5. Dec. 10, 1912. 'Overture 1812,' 10 sec. (1st. recognition.) "This air seemed slightly familiar almost from the first. My consciousness was entirely filled with vocal-motor and auditory images of the air, which anticipated the tones that were being played. There was a slight tension throughout my whole body. When the 'Russian National Hymn' came, the words 'Hail, Pennsylvania' appeared in vocal-motor imagery, with some innervation. Then vocal-motor '1812' followed in consciousness, and I promptly reacted on the key. Tension relaxed when the '1812' image appeared.

6. Jan. 16, 1913. 'Overture 1812,' 3.6 sec. (2nd recognition.) "The first thing of which I was conscious after the music began was the vocal-motor imagery 'I know that.' There was tension in forehead and eyes, but no images of humming. Then '1812' suddenly appeared in consciousness in vocal-motor imagery; tension relaxed and I found myself reacting."

7. Jan. 29, 1913. 'Overture 1812,' 1.4 sec. (3rd. recognition.) "Vocal-motor and auditory imagery of the word 'Hail,' sung in my own voice, and prompt reaction on the key, with relaxation following. The name of the selection came immediately afterwards, but was not a part of my consciousness of familiarity."

8. Jan. 29, 1913.⁶ 'Il Trovatore' (Verdi), 3.8 sec. (5th. recognition.) "Vocal-motor imagery of humming the air, anticipating the music after the second note. Then in rapid succession came the vocal-motor images 'Verdi group; Trovatore.' Slight muscular tension at first, diffused over the body, which relaxed at the word 'Trovatore.'"

9. Jan. 29, 1913. 'Brautlied' (Goldmark), 2 sec. (7th. recognition.) "Keen attention to auditory stimulus at first with nothing in consciousness but the auditory perception. With the fourth note,—that sliding one,—distinct vocal-motor imagery of singing that sliding note myself, followed by vocal-motor 'Goldmark's Bridal March,' and instant relief."

The Recognizing of Tactual Stimuli

10. Nov. 27, 1912. 'a' (Two dots in a horizontal line.) 7 sec. (4th. presentation; 1st. recognition.) "When I got this stimulus in

⁶ In addition to the progressive series of introspections, we have included here certain other introspections which illustrate points to be discussed later.

tactual terms I was aware of an auditory and vocal-motor image of 'a,' with a questioning accent. I had no high degree of certainty, however; and I inhibited my reaction and explored the stimulus further. A visual image of three dots arranged in a horizontal line came to consciousness, and with it a vocal-motor auditory 'f.' Then I was aware of a series of auditory vocal-motor images somewhat as follows: "'a' used oftener, simple, 'a,'" meaning that 'a' occurs more frequently than 'f' in actual use and therefore the simpler form of two dots would be employed to represent it. This, then, is 'a.' There was a diffuse bodily strain throughout until this last process, with relaxation at the end."

11. Dec. 12, 1912. 'a,' 2 sec. (6th. presentation.) "As soon as I got the tactual perception I had a vocal-motor auditory image of 'two dots.' Then I was aware of a tactual image of two dots, and a kinaesthetic image of reaching toward the right; 'a' followed immediately in vocal-motor auditory imagery."

12. Jan. 20, 1913. 'a,' 1.4 sec. (8th. presentation.) "I had a kinaesthetic and tactual impression of two dots in a horizontal position; and immediately afterwards a vocal-motor auditory image 'two dots, 'a.'"

13. Feb. 6, 1913. 'a,' .8 sec. (9th. presentation.) "A vocal-motor auditory image of 'a' came to consciousness immediately with my awareness of the number of dots in tactual terms, and of their horizontal position in kinaesthetic terms. Then I was aware of turning from the problem with instant relief."

The Recognizing of Olfactory Stimuli

14. Jan. 24, 1914. Ethyl Alcohol, 20 sec. (3rd, presentation; 1st. recognition.) "I sniffed it; and 'alcohol' came to consciousness in vocal-motor imagery. I was distinctly aware of the cooling sensation in my nose. It seemed familiar but no name came to me, and I was aware of unpleasantness, and the words Which one? Don't know. I'll never get them.' I kept on smelling, but the unpleasantness increased, and a general feeling of despair took hold of me,—a sinking organic sensation, which seemed somehow to include my whole body."

15. Jan. 31, 1914. Ethyl Alcohol, 17 sec. (4th. presentation.) "On perceiving the coolness which my first sniff of this produced in my nose, I said, 'Alcohol.' This was in vocal-motor imagery, with a rising accent. Then I smiled and said, 'Yes, alcohol. Let's see,—Ethyl or Methyl or Butyl?' Then I was aware of getting a drop of it on my nose and immediately had, in vocal-motor imagery, 'Now, I'll cough!' There was then a perceptible moment of waiting for that cough, and when it failed to appear, the Butyl possibility slipped out of consciousness altogether, and I said 'Methyl or Ethyl, not sure which.'"

16. Feb. 14, 1914. Ethyl Alcohol, 14 sec. (5th. presentation.) "I approached it with a definite perfume-*Einstellung*. I was saying to myself, 'They alternate, perfume,—alcohol—benzine group—perfume.' I took several whiffs before I could decide whether it was alcohol or perfume. This was present in terms of vocal-motor imagery of

⁷ It sometimes happened that successive introspections in a series were practically identical with one another. These duplicate introspections have not been included here,—the omission being indicated by a discontinuity in the serial numbers of (presentations or) recognitions.

this sort: 'Not perfume, alcohol; no, perfume; no, alcohol,' etc.; finally, 'mild alcohol.' Then I was aware of the coolness in my nose and attention was focused on this. The odor began to seem definitely familiar and I said 'cool in nose, mild alcohol, Ethyl.' My signal-tap ushered in distinct relaxation."

17. Feb. 21, 1914. Ethyl Alcohol. 9 sec. (6th. presentation.) "I was aware of the quality of the odor and then of vocal-motor 'alcohol? Not Butyl or Amyl; what—Ethyl, Methyl? Oh! cool in nose, Ethyl.' Then I turned to you, pleased with my success."

18. March 28, 1914. Ethyl Alcohol, 1 sec. (7th. presentation.) "Immediate vocal-motor 'alcohol—cool, Ethyl.' A high degree of certainty as I tapped."

Observer Fn.

The Recognizing of Visual Stimuli

19. April 21, 1913. Bulfinch 'E,' 8 sec. (5th. presentation; first correct recognition.) "The perception came in slowly and aroused a memory experience of myself going through this experiment at a former sitting. There was visual imagery of the room and the apparatus, and kinaesthetic and organic images of myself experiencing it all. Then followed imagery of a sitting previous to that in which I had noted this letter in the Bulfinch series. Two places in my visual schema claimed my attention here, and although there had been consciousness of familiarity throughout, it gradually increased in intensity until the names of those two places came in vocal-motor imagery: 'old Clearface,—Bulfinch.' The latter name was stressed and with its appearance the Bulfinch place in my schema⁸ became focal in consciousness."

20. April 28, 1913. Bulfinch 'E,' 1 sec. (6th. presentation.) "My perception of that letter thrilled me all over,—I was especially conscious of sensations of thrills in my chest. I localized this type in my schema, and the schema in my experience of last week; it was sufficient to make me absolutely certain. I said 'all right'; and it was not until after that that the name 'Bulfinch' appeared in vocal-motor imagery."

21. May 5, 1913. Bulfinch 'E,' 4 sec. (7th. presentation.) "The perception itself bore an intensive consciousness of familiarity, which seems to consist in its ease and readiness; the experience culminated in the instantaneous relaxation of the initial tension, as the Bulfinch part of my schema flooded into consciousness."

The Recognizing of Auditory Stimuli

22. Jan. 11, 1913. 'Brautlied' (Goldmark), 10 sec. (5th. presentation; first recognition.) "Four or five notes had gone before I realized that I was familiar with the air. My familiarity seemed to consist in the facility of my perception of the tones. I found myself turning back to repeat the first part in auditory imagery. My visual schema for the Tschaikowsky group came to consciousness vaguely,—indeed, it was so dim that I was not conscious that it was my Tschaikowsky schema until afterwards. It was merely a dim visual image of five gray blotches, and this air did not seem to fit into it,—no definite associations with this air occurred and the schema dis-

⁸ For description of this schema, see p. 351.

appeared from consciousness. Then I visualized a long note, on a music score, with four short notes straggling down from it, and then four others ascending the scale again." (This was *Fn.*'s schema for the 'Yelva Overture.') "My auditory imagery would not fit into that schema, either, so that possibility was discarded. Suddenly, with no discoverable antecedent, 'Natoma' occurred to me in vocal-motor and auditory imagery, and I was conscious of innervation in my reacting arm; but the reaction was inhibited by a new process,—I actually turned around and looked over across the table where, for some reason, I have always located 'Brautlied.' My whole attitude of body and mind was a questioning one. Then I turned back satisfied, tension relaxed, and I found my hand pressing the key. I was not aware of the name 'Brautlied' until afterward."

23. Jan. 27, 1913. 'Brautlied,' 5 sec. (2nd. recognition.) "Intense excitement. Familiarity just stirred my whole body. The whole situation in which I last heard this selection came up in visual imagery. Then 'Tschaikowsky' appeared in auditory imagery, but my attention turned from this immediately; and 'Brautlied' in auditory imagery, together with a humming of the air, filled my consciousness and I reacted."

24. March 3, 1913. 'Brautlied,' 1 sec. (3rd. recognition.) "The very first note had a perfectly definite familiarity,—simply thrilled me all over. That familiarity seems to be the sum total of my bodily reactions to the music. The name 'Brautlied' did not occur until a moment later, when it appeared in vocal-motor and auditory imagery."

The Recognizing of Tactual Stimuli

25. Nov. 23, 1912. 'e' (A single dot.) 16 sec. (2nd. presentation; 1st. recognition.) "As soon as I got a tactual impression of a single dot, I recalled the past situation here, in an endeavor to remember if any letter which had been presented had consisted of but a single dot. There was no familiarity in the actual experience, and I felt sure that the experimenter would never have given me so simple a figure. I attended keenly to the stimulus, and to both the visual and tactual imagery of other letters which had formerly been presented; 'g,' 'f' and 'h' stood out clearly. Then 'e' came to consciousness in auditory imagery of the experimenter's voice. Still no familiarity appeared. Then I had a tactual image of one dot, together with a visual image of a letter 'e'; I was not sure whether these were images of memory or of imagination. Still my image of the letter 'e' took its place in a visual schema which was then referred to the first day's experience and I reacted."

26. Dec. 14, 1912. 'e,' 5 sec. (4th. presentation.) "The tactual sensations called up a memory of the whole situation in which this stimulus was last presented,—not in visual imagery alone. The experience is rather that of living over again the former experience with its tactual imagery of this single dot, and auditory imagery of my own voice calling it 'e'."

27. Dec. 21, 1912. 'e,' 2 sec. (5th. presentation.) "I perceived a single dot immediately, but my attention was directed to an attempt to find more than one. I was conscious of exploring rapidly all around this dot several times. Then the 'e'-ness of that single dot became focal and had a sort of familiarity which seems to consist simply in my tendency to attend to it, though my finger was still

exploring for others. About this time, I called this stimulus 'e,' pronouncing the name aloud."

28. Feb. 15, 1913. 'e,' .4 sec. (8th. presentation.) "I had no more than touched the stimulus when a perception of the singleness of the dot came to consciousness. There was a visual image of the one dot, and just an immediate flash of familiarity which seemed to consist in the way the sensation attacked me,—the rapidity with which it came to consciousness, and the permanence of its quality. I was conscious of a motor response to it,—a sort of diffuse bodily thrill, faint, yet distinct. There is always something of this bodily thrill in my recognitions."

Observer Fs.

The Recognizing of Visual Stimuli

29. March 11, 1913. Clearface 'E,' 2.6 sec. (2nd. presentation; 1st. recognition.) "I examined this letter very carefully, noting the serifs and the hair lines; my attention seeming to turn naturally from one feature to another. My visual schema came into consciousness; and this letter located itself toward the last of the five blotches of the schema,⁹ one of which seemed to be more clearly defined. I was conscious of a mental effort to name all the blotches. The second from the top I called 'Bulfinch,' in vocal-motor imagery; then I named the one above it 'American Typewriter.' There was tension then, and a period of suspended action before I corrected this by calling the first 'Della Robbia' and the middle one 'American Typewriter.' Then my attention turned to the last two, vacillating between them for a time; but finally I paused for a perceptible interval on the very last. At the same time the name 'Clearface' came to consciousness in vocal-motor imagery and I reacted. There is no high degree of surety even now."

30. March 17, 1913. Clearface 'E,' 1.6 sec. (2nd. recognition.) "The first thing I noted was the general size and heaviness of the letter, and the difference in the widths of its lines. All of this was present in my visual perception of it. Then I had, almost immediately, a visual image of 'Clearface,' the word beginning with this particular 'C.' This was localized at the end of my visual schema, the rest of it being barely present to consciousness. I was not aware of any affective toning. I immediately tapped on getting my visual cue."

31. April 3, 1913. Clearface 'E,' 1 sec. (3rd. recognition.) "I perceived that the letter was large and had clearly marked differences in width of line. There was an immediate tendency to set my mouth for saying 'Clear—,' chiefly imaginal, I think. My attention was increasing all the while and my uncertainty decreasing. Finally, I said 'Clearface' and attention shifted immediately. There was scarcely any awareness of familiarity this time."

32. April 17, 1913. Clearface 'E,' .4 sec. (4th. recognition.) (The observer had been instructed, this time, not to react, nor to try to recognize, but simply to observe the stimulus-letter, and later to tell her experience.) "I was aware of an attention to the letter, of noting the widths of its lines together with its size and general boldness. The word 'Clearface' rushed into mind instantly, the syllable 'Clear' in vocal-motor, and 'face' in auditory imagery."

⁹ For a description of this schema, see pp. 354 f.

33. May 12, 1913. American Typewriter 'O,' .6 sec. (12th. recognition.) "I was immediately aware of the size and narrowness of the letter. My recognition of it was instantaneous and consisted in a tendency to react, *i.e.*, an awareness of tension in my right hand and about the muscles of my chest, as though I were holding my breath. The name appeared an instant later, in vocal-motor imagery, in very much abbreviated form: 'Am. Tyr.'

The Recognizing of Auditory Stimuli

34. Nov. 21, 1912. 'Natoma' (Victor Herbert), 10 sec. (2nd. presentation; 1st. recognition.) "With the first phrase of the music, I experienced a sudden kinaesthetic relaxation and a forward movement as though to get nearer the source of the sound. 'Dream of Autumn' came to consciousness in auditory vocal-motor imagery; then 'Tales from Hoffmann.' I had a strong tendency to react; I was aware of tension in my right arm. My foot was tapping, too. Suddenly that measure which contains the drum beats claimed my attention, and 'Natoma' rushed into consciousness in vocal-motor imagery. That process was accompanied by a forward movement of my whole body,—a thrill all over,—and then I reacted."

35. Dec. 2, 1912. 'Natoma,' 8 sec. (3rd. recognition.) "There was a slight consciousness of familiarity from the first. I paid close attention to the music and followed the rhythm slightly with bodily movements. I thought it was from some opera,—the word 'opera' being present in auditory vocal-motor imagery and after it 'Carmen.' (That merely by way of association.) This possibility was immediately discarded,—just slipped out of mind. Then I was aware of tension,—of a slight forward movement, and 'Natoma,—why, of course, Natoma,' came to consciousness in vocal-motor auditory imagery."

36. Jan. 16, 1913. 'Natoma,' 5 sec. (5th. recognition.) "At first I was keenly aware of the two chords and their minor quality. The air had a definite familiarity. There was slight tension, rather diffuse, and 'Natoma' appeared in vocal-motor imagery. With that I had a tendency to react,—this in terms of a vague awareness of kinaesthesia in my reacting arm. The reaction was inhibited by a recollection of having confused 'Natoma' with 'Dream of Autumn' before,—this being present to consciousness in terms of a visual image of two names printed one after the other, and some visual imagery of this room and of the situation at a former sitting. My certainty that this was 'Natoma' increased. The air went on and finally the 'Dream of Autumn' faded out of my imagery and I reacted."

37. Jan. 28, 1913. 'Natoma,' 3 sec. (7th. recognition.) "I fell into the rhythm immediately; felt my head and shoulders swaying with it, and started to react. It was perfectly familiar. Then the word 'Natoma' occurred in vocal-motor imagery and I gave the signal."

38. Jan. 16, 1913. 'Danse Trepak,' 7 sec. (7th. presentation; fourth recognition.) "With the first note there was perfect awareness of familiarity with the music. Could not react rapidly enough. The consciousness of familiarity was made up of two components: a rapid impulse toward the reaction-key, and a visual image which seems to be a product of that old image of the disc containing five selections, but this time it appeared as five very gray blotches which might be manuscript music. The upper blotches seemed clearer, and attention

was directed toward them. I wanted to give the signal because I was well aware that I knew the name of that air, but the reaction was inhibited. This is my interpretation of my awareness of strain in my poised, reacting hand."

39. Jan. 28, 1913. 'Danse Trepak,' 1.4 sec. (9th. presentation.) "On getting the first auditory sensation I immediately started following it out in vocal-motor and auditory imagery of humming and gave two taps, automatically. The absolute automatic perfection with which I fell into that music just seemed to be accompanied by the two taps. *Afterwards* I started to recall the name, getting a visual image of a phonograph disc, larger than the usual full-sized discs, and having five distinct divisions in its threads, marked by deeper grooves.¹⁰ My attention was directed to the first of these divisions, coincident with vocal-motor image of 'what' which meant: 'What was the name of that?'"

40. Dec. 2, 1912. 'Traviata.' (1st. presentation.) "There was no familiarity throughout the whole experience. The rapidity of the music first brought up a visual image of the disc with the five airs on it. This was non-focal, attention all the way through being on the music. The first tempo was very pleasing; I noticed that the trills were being played differently. The word 'new' in vocal-motor and auditory imagery was present with a decided inflection. There was intense kinaesthesia in the feet and hands, and I even went so far as to press the key automatically. My whole body seemed to swing; but no name occurred, nor was I aware of any search for one."

The Recognizing of Tactual Stimuli

41. Jan. 27, 1913. 'f' (The 'f' is represented by three dots in a horizontal line.) 10 sec. (5th. presentation; 1st. recognition.) "Just as soon as I became aware that the dots of the stimulus were in a straight line, the word 'what' came to consciousness, in a setting of the vocal-motor apparatus for saying 'what?' With this I had visual images of several different arrangements of dots which seemed to represent experiences similar to this in the past. A visual image of the letter 'a' appeared also, and all of this went to make up my attitude of 'What letter is this?' rather than 'Have I seen it before?' This attitude seemed to initiate my consciousness of familiarity with the stimulus. I then re-explored the group of dots to find the exact number of dots; and when I perceived that there were three, this attitude became still more intensive. I remembered that I had had this group of dots before, the remembrance consisting in a visual image of a card having three dots on it, together with bits of imagery of this room and the general situation. My 'what-is-it?' attitude persists, but I can not name this letter." (At this point in the introspection, the name of the letter was told to the observer.) "Now I remember; and the recall came in motor fashion. When I was learn-

¹⁰ The reference to a visual image is an experience which *Fs.* frequently described in connection with the five different Tschaikowsky selections, all of which were on the same disc. Danse Trepak was the first in order. In the initial learning the entire record was played through, a list of the names of the airs having been given the observer. This image ran a most interesting course in consciousness, gradually losing its details until it finally became little more than a visual schema.

ing this letter I associated it with the deaf and dumb alphabet in which the 'f' is made by passing the right palm quickly in a straight line across the up-turned left hand. That gesture came up in a flash of motor imagery when you mentioned the name."

42. Feb. 17, 1913. 'f,' 3 sec. (6th. presentation.) "That is 'f.' As soon as I got the tactful and kinaesthetic perception of the dots, arranged in a straight line, I had a kinaesthetic image of that manual motor movement which represents 'f' in the deaf and dumb alphabet. I also visualized my hands making the movement, then the 'f' came as a vocal-motor innervation. The whole experience seemed very familiar."

43. Feb. 24, 1913. 'f,' .8 sec. (7th. presentation.) "I got a tactful perception of a straight row of dots, a motor image of the movement for the 'f' of the deaf and dumb alphabet; and I named the letter immediately, with full certainty."

The Recognizing of Olfactory Stimuli

44. Jan. 31, 1914. Trèfle, 4 sec. (2nd. presentation; 1st. recognition.) "Trèfle. First I was aware of the fragrance of it in terms of attention to the odor itself. I was aware that it was a stronger and more intensive fragrance than the first I had had. That was an interpretation of a state of attention to the intensity of this odor itself, other things not being in consciousness. I do not think that I was actually aware of what I was comparing it with. Then there was the briefest possible visual image of a bottle inclosed in a basket casing which I now know was the same one I had associated with the word 'Oriental' once before. That seemed to function as a consciousness that it was not one of my distinct flower odors,—a consciousness, largely of the fact that more flower odors occurred to me as a possibility. As the word 'Trèfle' appeared it was unhesitatingly spoken. It appeared in auditory and vocal-motor verbal imagery; I was neither sure nor unsure; it was not a genuine recognition. I am not very certain. It seems that perhaps Trèfle was the first of this series that occurred and I spoke without thinking, almost. What I mean is that I can not characterize my certainty at the time because there was neither uncertainty nor certainty."

45. Feb. 7, 1914. Trèfle, 19 sec. (3rd. presentation.) "I think I said that was something that contained the least suggestion of cologne about it before. Marked recognition of it as a perfume. I was aware of a little tension, very slight, located largely in the throat, above the vocal organs. First I got the whiff and then this tension disappeared and there was a tendency to take the bottle away from my nose. Almost immediately started to say the word 'what' with renewed and much more keen attention to the odor than ever before. Took a deep whiff of it. No name whatever occurred and I was aware of slight unpleasantness and tension. Then I held the bottle down at my knee for a moment, all this time trying to think what it might be. Aware of this suspension in consciousness and this tension. Did not make any effort to reconstruct the past series. Then smelled the thing again, attending now to one thing and now to another. Tried to get an identifying quality but without success. Finally I thought I detected a slight suggestion of freshness that either I told you about or registered mentally as a criterion for one of these odors. That came simply as a visual image of a cologne bottle."

46. Feb. 14, 1914. Trèfle, 10 sec. (4th. presentation.) "Very uncertain, but it might be one of those violets. First of all I was aware that it was a fragrant odor and there was a slight pleasantness connected with that. That was purely in the nature of the smell. I found myself taking rather a deep whiff without any special effort to determine what it was; it was rather a mechanical response to the general situation of having the thing in my hand. Toward the close of that whiff, I became aware of the problem in hand. That was in a marked concentrating of my attention much more closely upon the smell, in a cessation of pleasantness, and I think a general but very slight kinaesthetic pulling up to the task, or readjustment. I should not say general,—it was localized in my chest and trunk. Then my attention singled out a very slight something which increases the violet quality. That is simply in terms of attention to an aspect of the smell. The word 'violet' occurred without any particular inflection,—either questioning or decision. There was another alternative. Almost immediately I became aware of a vague spatial schema,—I seemed to be attending to a grayish visual splotch, to the left of which was another very much less distinct splotch. That state of affairs was a consciousness that the odor was not very well identified as violet and that it might belong to that group of non-flower odors. I never reached any great degree of certainty."

47. Feb. 21, 1914. Trèfle, 12 sec. (5th. presentation.) "There was a short period, at first, during which I was adjusting myself to the fact that the odor was a perfume. I simply did not try to select out any characteristic quality at the outset. I soon began to do this and then had a peculiar schematic consciousness of discarding all the flower odors. This came in visual imagery of a table, with about twenty-five bottles on it. (I did not recognize it then, but now I know it was a Wellesley scene.) Then these receded as though pushed away by an arm,—which, however, I did not see. All the time my attention was partly occupied, too, by a non-flower-like quality in the fragrance. I then took a deep whiff, and the word Trèfle appeared. Still I did not have a tendency to turn away from the problem, as happens when the name comes with great subjective surety. I smelled it once more, and was aware of a certain delicacy in the fragrance. Then I said, 'That's Trèfle,' exhaled my breath, and relaxed. I was sure I was right."

48. March 14, 1914. Trèfle, 2.2 sec. (6th. presentation.) "Is that Trèfle? Took a fairly deep whiff of that,—the rather strong non-flower quality of it stood out. 'Quelques Fleurs' occurred for an instant in clearly auditory terms,—possibly visual, too. Immediately I attended away from the Quelques Fleurs. Then the word 'Trèfle' started to say itself. Barest sort of set of the mouth for the 'T' sound. Then a little catch of the breath and I asked very suddenly, 'Is it Trèfle?' There seemed to be no affective toning in that experience. It was more a sort of suspense, waiting for the answer. Of course the awareness of the perfume was present all through this."

49. April 4, 1914. Trèfle, .8 sec. (7th. presentation.) "That is Trèfle. That was an immediate recognition. The odor was mild at first. While I attended to it carefully I did not get a very satisfactory whiff of it until rather late in the first whiff. Just as soon as it stood out my attention focused on a peculiar quality of mildness,—lack of that overpowering sweet quality. This had a milder and different quality. My attention pounced on that. It stood out very suddenly and I said afterwards 'That is Trèfle?' The words

seemed to come spontaneously and I said them with an inflection of certainty."

Observer W.

The Recognizing of Visual Stimuli

50. March 7, 1913. Della Robbia 'N,' 10 sec. (2nd. presentation; first recognition.) "The moment I perceived it, there was a slight familiarity; a whole mass of associations came in. There was a visual image of an 'N' I had before today; then of another 'N'; then I went through the list of types. 'American Typewriter' was present to consciousness for the briefest space of time in visual imagery. Then I visualized the name 'Della Robbia' printed in small (lower case) letters. My attention turned from that to Clearface and I became aware of 'Clearface' in vocal-motor terms with a questioning accent. Then a visual image of a Della Robbia 'S' stood out in consciousness and seemed exceedingly familiar,—the serifs were just like those on this 'N.' I visualized both and said 'Della Robbia' instantly.

51. March 14, 1913. Della Robbia 'N,' 2 sec. (6th. presentation; second recognition.) "I noted during the presentation that the lines were of uniform thickness, and that the letter was large. That was followed by an intense strain in my vocal-motor apparatus, which meant that I knew the type and had a keen desire to say something, but I had absolutely no idea of what the name was. Then a visual image of the two 'l's' and the two 'b's' of Della Robbia rushed into consciousness and touched off my vocal-motor response 'Della Robbia.'

52. April 24, 1914. Della Robbia, 'N,' 1 sec. (7th. recognition.) (Recognitions three to six were practically identical with that quoted above.) "I noted that the lines were uniform, and that the letter was large. First there was a sudden increase in my familiarity with a movement of my lips to say 'Bulfinch.' Then I had a visual image of two 'b's' and I immediately said 'Della Robbia.' Tension was instantly relieved."

The Recognizing of Auditory Stimuli

53. Jan. 17, 1913. 'Overture 1812' (Tschaikowsky), 10 sec. (3rd. presentation; 1st. recognition.) "When the music first began, I was aware of the character of the music as such,—it was fast and confused. I was conscious, too, that my attention was not very alert at this time. The next thing I perceived was the beat of that rhythm, this perception seeming to consist in an ability to anticipate the note in auditory fashion. A slight feeling of pleasure accompanied this. Then suddenly, I was aware of the *Aufgabe*, which seemed to be present as an effort of keener attention. Several successive visual images now came in; the first was the word 'Tschaikowsky'; next the word 'Danse Trépak,' accompanied by a fleeting visual image of a Russian dance. There was now an increased familiarity which seemed to be associated with the image of a piece of paper localized off in space, but no word was perceptible on it. I thought I knew what the name was, however, this being present in a faint visual image of 'Tschaikowsky' off in the fringe of consciousness, located at the left. I was conscious of kinaesthetic sensations in the region of my mouth which was opened as if to say 'O.' Then suddenly I

found myself pronouncing 'Overture' and immediately 'Overture 1812' appeared upon my visual image of the piece of paper. My reaction then followed in mechanical fashion."

54. Jan. 20, 1913. 'Overture 1812,' 5 sec. (2nd. recognition.) "When the music began my attention was diffuse. I noted the accompaniment in the bass and it seemed slightly familiar. I found myself attending closely to those chords; I visualized them on a manuscript. At the same time, I recalled having heard such chords before,—this is an association of my manuscript image, with faint visual images of the situation here in this experiment on two former occasions. I then anticipated, in a clear auditory image, a phrase in the treble which is my criterion for this selection. When the anticipated phrase came, there was a relaxation, together with a visual image of 'Overture 1812' in your handwriting, a short distance out in space in front of my eyes."

55. Feb. 17, 1913. 'Overture 1812,' 3 sec. (3rd. recognition.) "The music at first did not bring any familiarity. I seemed scarcely to perceive it. Suddenly an awareness of the auditory impression rushed in upon me and I hurriedly went over the music I had already had, with auditory imagery of the air in the treble and of the accompaniment in the base. It was now very familiar. Vocal-motor image 'Overture 1812' followed by 'Tschaikowsky' rushed into consciousness instantly and I was aware of a relaxation of tension."

56. Jan. 20, 1913. 'Il Trovatore' (Verdi), 2 sec. (5th. recognition.) "My attention was keen when the music began. I was instantly aware of that chord which stands out in the bass, in four beats. Not more than two chords had been struck in the accompaniment before I anticipated the rest of the measure in vocal-motor auditory imagery. This made me absolutely sure that it was the 'Il Trovatore' selection, and all tension relaxed."

The Recognizing of Tactual Stimuli

57. Nov. 21, 1912. 'y.' (This letter is represented by three raised dots, arranged in the form of an equilateral triangle, with its apex above a horizontal base.) 26.4 sec. (2nd. presentation; 1st. recognition.) "When I first explored the dots, the word 'new' came to consciousness in vocal-motor imagery. At the same time I was dimly aware of a number of past experiences with these letters,—'z' and 'c' appearing fairly clearly in visual imagery. I associated the stimulus with 'z' at first, visualizing the dots on the lower line as three in a straight row. Then I visualized the upper line of 'z' and explored for it with my finger. But I could find no upper line in the stimulus, and 'z' dropped out of consciousness. Next a visual image of a typewriter 's' appeared but it seemed new and strange and it in turn slipped out of mind. All the time my visual image of the arrangements of the dots was clearing up; when it became definite, a visual image of a type 'y' stood beside it and I reacted. Later I recalled going through this last process in learning it before."

58. Dec. 6, 1912. 'y,' 5 sec. (4th. presentation.) "With the first tactual impression, I visualized a triangle having two long sides, and a shorter one to the left. Then, a visual image of 'y' appeared as though superposed upon this triangle. This experience was rather unpleasantly toned, and the words 'more time' came to consciousness in vocal-motor imagery which, together with a more deliberate exploration of the stimulus, meant that I must examine it more closely.

My visual image of the group of dots became clearer, and my familiarity greater. My triangle became equilateral, with its base toward me; and a visual image of 'y' appeared beside my image of the dots. This, together with a memory image of myself sitting here before, completed my recognition."

59. Feb. 14, 1913. 'y,' 2.8 sec. (6th. presentation.) "On first getting the tactful impression, I had a vocal-motor image of 'v' with a visual image of these three dots arranged in triangular form, but no definite localization of the base or apex. This visual image, however, cleared up immediately and the base was toward me. Then a visual image of 'y' appeared and my attention turned to you."

60. Feb. 21, 1913. 'y,' 1.6 sec. (7th. presentation.) "I immediately visualized the stimulus as a triangle with its apex upward, and said 'y.' That was all,—no visualization of the type 'y' and no feeling of familiarity. Whole experience seems automated."

The Recognizing of Olfactory Stimuli

61. Jan. 24, 1914. Coast Violet, 9 sec. (2nd. presentation; 1st. recognition.) "It is familiar but I can not get its name. Attention lingered upon the actual quality of the sensation only for an instant. The sensation seemed to be of slight intensity and was visualized, at the opening of the nostril, as a little amorphous gas. Immediately following this came a series of visual and vocal-motor imagery. First the visual, in which I saw a portion of ground and on it was a plant just coming up, something like a skunk cabbage; its top was chopped off. Vocal-motor strain to say something and there was nothing to say. Strain was so intense that attention shifted for an instant to a visualization of my speech apparatus, with muscles in state of contraction. Only thing that came in was the word 'herb' repeated two or three times. General physical state of tension, localized in the speech apparatus, and about the face. These processes, together with the accompanying pleasant affective toning and the absolute predominance of this imagery,—the abandoning of everything else,—was the structure of this familiar toning. It was a one-level consciousness. The visual image of this stump and the vocal-motor 'herb' were so intense and clear and sudden that it made the familiarity a very intensive experience, though I can not name the perfume."

62. Feb. 7, 1914. Coast Violet, 15 sec. (3rd. presentation.) "I have not the slightest idea what it is. I visualized, in the fore-period, the processes of putting it up to my nose. I was aware of the *Aufgabe*, in auditory vocal-motor imagery: 'See if this is familiar.' The sensation first came as a strong, penetrating odor. It tickled the membranes of my nose and had a slight oily quality. The sudden attraction of attention to the quality and the persistence of that quality in the perception; a welling-up of pleasant affective toning, plus a mass of imagery of previous sittings which came in just like a flash; an actual memory-image of that same odor before,—all that stood out; and I interpreted the whole experience as familiarity with this odor. The word 'Quelques Fleurs' appeared in auditory imagery almost as soon as I perceived the pungent, oily quality, but I have never associated that oily quality with Quelques Fleurs. For a few seconds I was aware of the *Aufgabe* to try to get the name of it. This consisted in vocal-motor 'get the name.' Then followed series of visual images of bottles lying on the table; and snatches of auditory imagery: Rose, Coast Violet, Acme Violet,' but with faint olfactory

imagery of violet-like odors. Then it was all off, because I laughed. These images died away and no more came in and all I was aware of was strain and the occasional presence of the *Aufgabe* to find a name. Attention lingered on these processes for a while and then I said I had forgotten what the name of it was."

63. Feb. 28, 1914. Coast Violet, 13 sec. (4th. presentation.) "The odor immediately gave rise to memory-images of former sittings in this experiment. Its quality was unpleasantly pungent, and I experienced a motor tendency to recoil. Then I began analyzing the sensation, and noted that it seemed oily. I visualized it as something greasy on the inner membranes of my nose. The experience now became pleasant. There was a lot of ill-defined imagery of former experiences in this room,—visual, olfactory and auditory,—and I heard myself saying, 'Why, yes, I know that. What's its name?' There followed imagery of your voice saying 'Trèfle; Coast; Acme,' and others. Then came visual images of a big herb, like a skunk cabbage, growing out of the ground. Auditory imagery of the words 'herb' and 'Coast' persisted in appearing and I said: 'This must be the one.' Intense pleasantness now toward the experience, but immediately there appeared in consciousness simultaneously, visual imagery of many bottles, with attention moving from one to another, and an experience of doubt."

64. March 21, 1914. Coast Violet, 7 sec. (5th. presentation.) "I am not certain of my identification. Very little imagery. Nothing called up. I found my attention shifting from the bottle in my hand to the actual olfactory sensation itself. I found myself attending to a sort of pungency with a violet-like quality which came to me somehow associated with a visual image which seemed to be like a purple dome. The presence of a little off-shoot in this dome, with a kinaesthetic image of jumping back, was the structure of what meant to me 'there is a new factor which I did not distinguish before.' This intensive experience was followed by a faint visual image of a patch of ground with an herb coming up. Then that faded out and my attention was entirely taken up with the experimental surroundings."

65. March 28, 1914. Coast Violet, 14 sec. (6th presentation.) "It is as familiar as can be, but I can not be sure of the name. The first name that came was Coast Violet. Another possibility was Trèfle. Those were the two clearest ones. Very keen concentration of attention. Auditory *Aufgabe*: 'Now get the essence of this' with concentration of attention upon it. First I took a long, deep whiff, and I was distinctly conscious of doing it; it seemed to be an activity directed by the *Aufgabe*. Visual and auditory imagery followed in rapid succession, accompanying this deep inhalation. My attention went to the particular quality of the olfactory sensation; this was almost a visual and cutaneous thing. I had a visual image of a film, very thin and brownish, in the inner side of the left nostril. It was smooth and shiny and that with the peculiar contraction of the tongue in the back of the throat, and also a contraction of the diaphragm meant to me this pungent odor. But almost immediately following this there was auditory image 'pungent'; then attention shifted to another aspect of this quality. It seemed watery and almost gaseous; reminded me of illuminating gas. This was immediately followed by a visual image of a surface of the ground; saw lot of plants coming up; did not know what they were but I know now that they were skunk cabbages; saw them lying there among moss and wet leaves.

This was immediately followed by an auditory image, turning into visual, of Coast Violet. Then there was an experience of doubt, I could not seem to leave the problem. Memory images of past experiences persisted to demand my attention."

66. April 4, 1914. Coast Violet, 2 sec. (7th presentation.) "That is Coast Violet. At first I was not even aware that it was a perfume. I noted that the sensation was weak, and I inhaled deeply. Then I felt a sort of contraction in the back of my throat and tongue; this sensation seemed to extend to my diaphragm. Then I visualized an oily surface low in my nostril. The experience became very pleasant. Almost simultaneously my attention fastened on a visual image of a meadow, which seemed at my very feet, and in which were some hazy, ill-defined plants, which, I suppose, were my skunk cabbages. But instead of attending further to them, I found myself experiencing more intensive sensations in my stomach and diaphragm, and these were superseded by a visual verbal image of Coast Violet, the Coast appearing very prominently, written in white on a black background. I settled back in my chair with great satisfaction as I gave the signal-tap."

Observer V.

The Recognizing of Auditory Stimuli

67. Dec. 9, 1912. 'Brautlied' (Goldmark), 20 sec. (2nd. presentation; 1st. recognition.) "The air seemed slightly familiar from the first. My familiarity with it seemed to consist in the clearness of my perception of the sound, together with kinaesthesia in my entire body,—swinging to the rhythm. An impulse to react, consisting of a series of tactful images of pressure on the key, was inhibited,—no name having yet come to consciousness. Then my attention was concentrated on the stimulus, and when that little "skip" in the music occurred, it brought a vocal-motor image of 'Bridal Song.' I reacted to that, and then ceased to attend to the thing."

68. Jan. 28, 1913. 'Brautlied,' 10 sec. (3rd. recognition.) "It was familiar from the first, the thing clearest in consciousness being my attention to the stimulus and my inhibition of a strong tendency to react." (The hand was poised over the reaction-key in a tense position.) "I visualized a threshold with a pair of feet in white satin shoes skipping over it. Then came a change in my kinaesthesia, —innervation in my feet and changed respiration. There was a pleasant affective toning and vague vocal-motor and auditory images of the act of describing something like this before. My reaction was followed by marked relaxation."

69. Feb. 25, 1913. 'Brautlied,' 5.4 sec. (5th. recognition.) "The familiarity came first as the memory-image of my kinaesthetic adjustment to this air,—that peculiar experience of thinking that you have done something years ago in exactly the same way in which you are doing it now. Just before I reacted, there was a visual image of a low door-step and a small white foot just going over it. This visual image was supplementary, I think, and more or less irrelevant to the familiarity itself, which consisted in kinaesthetic adjustment, followed by relapse of tension."

70. Feb. 25, 1913. 'Danse Trèpak' (Tschaikowsky), 2 sec. (5th. recognition.) "Immediately on noting the stimulus, my whole body seemed to sway in motor imagery, which was so clear as to seem

almost like actual movements. The facility and clearness of my perception of the music, together with this motor response, constituted absolute familiarity. 'Danse Trèpak' in vocal-motor terms immediately followed this experience."

The Recognizing of Tactual Stimuli

71. Nov. 21, 1912. 'a,' 4 sec. (4th. presentation; 1st. recognition.) "There was a slight familiarity as soon as I got my tactual perception of the dots. I was impelled to count them, however. My attention was held involuntarily to that activity. I explored the dots one at a time. Then I got a visual image of two dots which seemed to be perfectly familiar, though no names presented themselves,—and, indeed, no name occurred until I actually said 'a.'"

72. Dec. 6, 1912. 'a,' 3 sec. (5th. presentation.) "I had an anticipatory visual image of two dots when my finger touched the first one. There was a vocal-motor image of 'a' followed by a vocal-motor image of 'e.' My attention again fixed on the visual image of the two dots, and I reacted to the vocal-motor 'a,' which then became focal in consciousness."

73. Jan. 31, 1913. 'a,' 1 sec. (6th. presentation.) "The tactual sensation was immediately familiar,—the tension all over my body was instantly relieved. Then there came to mind a visual image of a large, black capital 'A.'"

The Recognizing of Olfactory Stimuli

74. Feb. 23, 1914. *Quelques Fleurs*, 4.8 sec. (2nd. presentation; 1st recognition.) "The first thing of which I was conscious, after sniffing the odor, was intensely pleasant affective toning. Am sure of quickened heart action and increased sensation of warmth, beginning about the middle of the torso and proceeding upward. Then the name 'Quelques Fleurs' came, visually, printed in violet colored, rather fancy letters. My attention was narrowed intensively, and when I reacted, there was a distinct sense of relaxation."

75. March 1, 1914. *Quelques Fleurs*, 6 sec. (3rd. presentation.) "I recognized immediately that it was a perfume, and very pleasant. This recognition and a feeling of confidence that I could identify it was present, I think, just in the manner in which I put the bottle up to my nose for a further examination of the odor. On getting a clear perception of its quality, the word 'Quelques' appeared in Japanesey letters, on a large, cut-glass bottle, of which I saw only the neck and the stopper, which was frosted. Then I said 'Quelques Fleurs,—that's my favorite of all your perfumes.'"

76. March 3, 1914. *Quelques Fleurs*, 2 sec. (4th. presentation.) "A strong feeling of pleasantness accompanied the sensation. At first, my attention seemed very diffuse and I was aware only of the odor quality and of its great pleasantness. Then suddenly 'Quelques Fleurs' rushed into mind in vocal-motor imagery, and I knew this was a familiar odor, and reacted immediately."

77. March 22, 1914. *Quelques Fleurs*, 2.6 sec. (5th. presentation.) "That was an experience of immediate and direct assurance. Strong pleasantness was the first thing in consciousness, after a perception of the odor quality. A deep intake of breath followed, and a visual image of an advertisement for *Quelques Fleurs* which I saw in '*Life*' last week. There followed an auditory image of my own voice, saying, as I then said, 'Now, you've got it in print, after all those

visual images you've had of it. *Quelques Fleurs.*' Then I pronounced it aloud. But all of this last was quite incidental to the recognition, which was complete when I took the deep breath."

Observer B.

The Recognizing of Auditory Stimuli

78. Dec. 5, 1912. '*Il Trovatore*' (Verdi), 6 sec. (3rd. presentation; 1st recognition.) "The first note seemed to draw my body over toward it. I experienced a motor tendency to keep time, an innervation of the throat as in humming, and kinaesthetic imagery of swaying with the rhythm. Then I went back in memory, to my first sitting here, for a name,—this in visual imagery of the situation here. A momentary search, an attitude of listening, and '*Trovatore*' came to mind in auditory imagery."

79. Jan. 9, 1913. '*Il Trovatore*', 3 sec. (2nd. recognition.) "That was familiar immediately; my attention was narrowly focused, my breath was held, and I was conscious of muscular tension all over my body. The whole experience was pleasantly toned. As the first note ended I had a flash of auditory imagery of the next tone, which was swamped immediately by my perception of the tone itself. Tension instantly ceased. The name which then came in auditory vocal-motor fashion added nothing to my surety."

80. Jan. 23, 1913. '*Il Trovatore*', 1 sec. (3rd. recognition.) "The familiarity with that was perfect from the first perception. It seemed to consist in the clearness and the directness of the perception itself. There was the merest intimation of kinaesthetic imagery of swaying with the rhythm, followed by relaxation and turning to introspect."

81. Jan. 30, 1913. '*Rigoletto*', 15 sec. (1st. recognition.) "My experience consisted of a perception of the tone quality and phrasing, together with a flash of visual imagery of a previous sitting in this room. I seemed to grope over in the direction of the table (where the experimenter always sat) as though to get the name from over there. My visual schema was present, too,—that image of four gray blotches descending obliquely toward the right, on a lighter gray background, and ending in a curving line. There was a motor experience also, in this schematic imagery. I seemed to move with the blotches and the curved line. When the phrase which fitted into this schema was played, the name '*Rigoletto*' sprang into consciousness, in auditory vocal-motor imagery."

Observer O.

The Recognizing of Olfactory Stimuli

82. Jan. 31, 1914. Amyl Alcohol, 3 sec. (2nd. presentation; 1st. recognition.) "On perceiving the stimulus there was a recognition process which was very intensive; it seemed to be an organic drawing up in the upper part of the diaphragm, together with vocal-motor imagery of 'That's the one.' Sensation seemed to grow increasingly intense; it seemed to increase way back in the back part of the nostril. Vocal-motor imagery 'alcohol' came up and then vocal-motor 'Oh, I don't know whether it is Ethyl or Amyl alcohol; but I know the odor.' That came in scraps like 'Amyl, Ethyl,—don't know; anyway, it's that one,' which meant it was the one which

made me cough. Slight, pleasant affective toning accompanied by vocal-motor 'Well, I know that, but I don't know its name.'

83. Feb. 7, 1914. Amyl Alcohol, 3 sec. (2nd. recognition.) "In the fore-period, I had a vague visual image of my hand holding the vial and it seemed to be a visual image of motion,—just a line very slowly drawn toward me. There was a very quick recognition process, though the name did not come to me. It consisted in a very clear and precise percept of the odor, accompanied by vocal-motor 'one of the old ones' and also 'one of those bad ones.' I could not name it. There was vocal-motor 'one of the alcohols?' Then there was a pause and during that pause the unpleasant affective toning continued. There was strain in the forehead. Vocal-motor imagery of 'what, which one?' There was no answer to that and the last thing in consciousness was that 'what, which one?' all accompanied by unpleasant affective toning."

84. Feb. 14, 1914. Amyl Alcohol, 1 sec. (3rd. recognition.) "On perceiving this there was unpleasant affective toning which lasted only a very short time. Then there was a quick change to a pleasant affective toning and a vocal-motor 'Oh, there it is,' and 'that is the bad one.' That completed my recognition. 'What's its name? Is it Amyl? Yes, Amyl,' followed, in vocal-motor imagery."

Observer S.

The Recognizing of Olfactory Stimuli

85. Feb. 7, 1914. Cresol, 17 sec. (2nd. presentation; 1st. recognition.) "The very first perception was followed by vocal-motor imagery, 'It is either Phenol or Creosote. Now which is it?' This was followed very, very quickly, by clear olfactory imagery of creosote, which was apparently quite separate and apart from the actual olfactory sensation. There was a recall, also, of the characteristic mark or sign of the creosote odor,—the peculiar way it affects the lower part of the nose and persists. I was next aware of inhaling and of letting the gas out very slowly. This was followed by very pleasant affective toning and vocal-motor imagery of 'that's it; that's Creosote.' But I couldn't let it go at that. The adjustment was not complete. It was followed by another rise in the attention wave. I was aware of a visual image of a little square bottle on which was the word 'Mapleine'¹¹ and I was aware then of olfactory imagery of the odor of Mapleine. This imagery was broken into by a consciousness of self and of you and this consciousness of the conditions of the problem was further developed by the vocal-motor imagery, 'Well, she would not give me that kind of an odor.' Then my attention narrowed. I was aware of unpleasant affective toning, and of the following vocal-motor imagery: 'Oh, that's all right; that's creosote, all right. The mapleine is an artificial preparation and the chances are they use creosote in making up that Mapleine.' Then my attention shifted and I turned to introspect."

86. Feb. 14, 1914. Cresol, 8 sec. (2nd. recognition.) "The perception was complete at first and persisted in great clearness. The first thing I was aware of was the vocal-motor phrase 'maple sugar.' Then there was a very brief series of olfactory and visual images, connected with the experience I had here the other day when that

¹¹ This observer reports that Mapleine is a synthetic substitute for maple syrup; it is characterized by a faint odor of creosote or tar.

maple sugar characteristic was assigned to the creosote. I think it was mostly in olfactory imagery. I had very fleeting visual images of the bottle marked 'Mapleine,' and I was aware of attending to a particular part of the stimulated nostril,—the lower part. Then just the words 'maple sugar,' followed an image of the Mapleine bottle and a few of the details of the former experience here. Then the word 'creosote' came automatically."

87. March 7, 1914. Cresol, 6 sec. (3rd. recognition.) "I was aware of making a definite motor adjustment to the sensation,—of breathing easily, in shallow breaths, and of attending to the lower part of the olfactory membrane. Then there was a definite awareness of attending to the persisting sensation and waiting for something to happen. Finally the words 'Oh, that's creosote,' came in vocal-motor imagery, and my assurance was complete. Later I had olfactory imagery of that characteristic maple sugar quality and then my attention was directed to an image of this Mapleine bottle. I said, 'That's creosote, all right,' and was aware then of general relaxation."

88. March 14, 1914. Cresol, 2.4 sec. (4th. recognition.) "That is Cresol. I was aware that I was inhaling and then exhaling, that the lower part of the olfactory organ was being stimulated, and that the sensation persisted after the bottle was removed. Even after I had breathed through my nose two or three times I was aware of the stimulation still there. This persistence of the sensation seemed to be the antecedent to the coming in of all the experiences I have had where the persistence was a factor. Almost the first one that came was the maple sugar. I had a very indefinite, inadequate image of a lump of maple sugar. I was aware of the persistence of the odor after I smelled it. This meant to me that this was undoubtedly the Cresol."

89. March 21, 1914. Cresol, 2 sec. (5th. recognition.) "I attended first to the characteristic quality of the stimulus. It is a queer smell quality,—coming intermittently, and affecting the lower part of my nose like little particles of dust. Its persistence attracted my attention and I was aware of vocal-motor imagery, 'that's Cresol.'"

Observer Bd.

The Recognizing of Olfactory Stimuli

90. Jan. 24, 1914. Halycon Rose, 4 sec. (2nd. presentation; 1st recognition.) "On smelling that, I had a reinstatement of the mental experience which I described at the last sitting,—an association with the odor of wild roses, and vocal-motor 'briar.' The whole thing seemed very familiar. After I reacted, I had a visual image of the part of the wild rose that is left when the petals come off."

91. Jan. 31, 1914. Halcyon Rose, 17 sec. (3rd. presentation.) "I don't know what it is. That was rather a remarkable experience. With the first inhalation of the right nostril I got the quality of the odor very distinctly but was also conscious of unfamiliarity, uncertainty. I began a second inhalation, and suddenly, during the course of that inhalation there came up a feeling of familiarity, but it was a feeling, largely organic, in the upper part of the chest and upward,—not very intensive and not definitely localized, lasting only for a brief time. With that came the vocal-motor imagery 'going to get it,'—a fragmentary sentence which indicated that I was on the point of getting the identification. Then feeling of familiarity disappeared and attention lapsed."

92. Feb. 7, 1914. Halcyon Rose, .9 sec. (4th. presentation.) "‘Perfume’ came immediately in vocal-motor terms, and with that a feeling of familiarity which I should say was largely organic in the upper chest region; pleasant. ‘Quelques Fleurs’ was present in vocal-motor terms, but I was not at all sure of my identification. Then I smelled it again. Just at the end, I got that peculiar briar quality that I spoke of the other day and immediately ‘briar’ came, vocal-motor, and ‘rose,’ vocal-motor. I am quite certain that that was rose."

93. Feb. 14, 1914. Halcyon Rose, .8 sec. (5th. presentation.) "Almost with the beginning came the word ‘p-e-r-r-fume,’ drawled out in vocal-motor terms, with the inhalation. I felt myself pronounce this in that long drawl. Not aware of any specific feeling of familiarity. Along toward the finish I got a slightly changed olfactory quality; and the word ‘briar’ appeared in auditory terms. I am surprised at the amount of auditory imagery this morning because it is so unusual. My identification was not yet complete. I was led to suspect that it was going to be rose because of that ‘briar.’ Then I smelled it again. I approached that with a very definite *Aufgabe*, vocal-motor terms: ‘Is it rose?’ Found myself very tense and very alert and active, examining my experience very closely; but I was disappointed,—the word ‘rose’ never occurred after the *Aufgabe*, neither did ‘briar,’ simply a fairly intensive olfactory quality and not a single name associated. My experience was,—starting out with this *Aufgabe*,—a very, very definite olfactory quality, a certain tenseness, a certain disappointment, and an uncertainty."

94. Feb. 21, 1914. Halcyon Rose, .4 sec. (6th. presentation.) "The instant I began to sniff came ‘perfume’ and feeling of familiarity,—very intense. Then it disappeared and this vocal-motor imagery came in automatically: ‘It must be briar; she has given me Quelques Fleurs; she has given me Coast Violet; she has given me Acme Violet.’ That was all very syncopated. Meanwhile I did not attend to the odor at all. As yet I had not got any qualitative rose odor at all, but after that thing that I call a logical inference, suddenly there welled up that peculiar unmistakable briar quality, and I knew then that it was rose. I said ‘rose’ and then turned to introspect."

95. March 7, 1914. Halcyon Rose, .8 sec. (7th. presentation.) "With the very beginning of the sniff, I had a vocal-motor image of ‘rose.’ I continued to sniff, and the quality changed to that briar quality. ‘Briar’ came in vocal-motor terms, and my surety increased. The whole experience was slightly pleasant, though not markedly so."

96. March 14, 1914. Halcyon Rose, .8 sec. (8th. presentation.) "‘Rose’ came immediately, in vocal-motor terms, and I felt absolutely certain of my recognition of the odor. I hesitated for a moment before tapping, as though expecting that briar quality to come, but it didn’t. This was simply a case of actively waiting for the quality to appear. Meanwhile, I had a distinct olfactory image of that briar quality. Yet, I was aware throughout of the actual olfactory sensation which this stimulus brought. I think it was a case of rapid alternation of attention from sensation to image. There was no affective toning."

B. The Functional Components of Recognition

a. *The rôle of the Aufgabe.* The essence of the process of recognition is function, not content. It is true that the content

of the act of recognizing exhibits certain interesting and important characteristics which bear a direct relation to the degree of familiarity which the object recognized possesses. But, given the same images, sensations and affective elements, together with a different *Aufgabe*, a changed order of events and a new reaction to them, and the result will be a mental process of an entirely different nature. It is the pattern into which the warp and woof of sensation, image and affection is woven which gives its characteristic nature to the cloth we call recognition; and this pattern is dependent upon the behavior of attention, directed by the *Aufgabe* to recognize.

Although the *Aufgabe* was not always explicitly present, and although it was seldom focal, its influence on the cognitive experiences of our observers was evident throughout. When the observer was explicitly aware of the task to recognize, this awareness most frequently took the form of vocal-motor processes such as: 'Now, get this'; or 'What is this?'; or 'Is it De Vinne?'; or, more frequently, a telescoped and fragmentary representative of such a consciousness,—often a mere beginning of the word 'What?' Consciousness of diffused bodily strains, an awareness of the hand poised above the reaction-key, a tension in the vocal-motor organs,—as though they were about to pronounce a name,—these structural components were again and again described by our observers as constituting their task-consciousness or as partially composing this consciousness. Certain other structural elements appeared in individual cases. For example, *W.*, on several occasions, described an *Aufgabe* whose structure was a 'visual image of the experimenter, wearing an expectant expression of countenance.' Again (53, p. —) he was aware of his task as a consciousness of increased effort to attend narrowly. In many cases the recognition *Aufgabe* was not clearly present in explicit terms, but appeared rather in the attitude which the observer took up toward the stimulus presented. In such cases it was implicit in the sequence of noting, comparing, contrasting and the like; and in the release of tension which completed the act of recognizing, and which constituted an attitude that the task had been accomplished,—an attitude or a mode of behavior too implicit to be called an awareness.

The *Aufgabe*, explicit or implicit in the activity itself, serves to direct the attention to the characteristic feature of an object presented for recognition; to call up, in certain cases, associated imagery or other processes; to institute certain acts of

comparing, weighing, accepting, discarding, and the like; in a word, to direct the entire course of the activity.

Such dispositions, once set up, were exceedingly tenacious; and they persisted in many instances, notwithstanding opposite instructions on the part of the experimenter. Wide individual differences in such cases were brought out in a variant of the experimental procedure, where the observer was instructed not to search for the name of the stimulus presented, and not to attempt to recognize it,—but merely to perceive the object exposed and allow an entirely passive consciousness to run its course. Two of our observers found themselves utterly unable to follow this instruction. A strong disposition to identify the stimulus directed their attention in the customary channels, in spite of their attempts to inhibit this activity.

One of the most striking manifestations of the functioning of a deep-seated *Aufgabe* occurred in a still different variant of this experiment, where the letters presented in the recognition series were printed in red ink instead of in the usual black.¹² *Fn.* entirely failed to apprehend the difference in color in all of the ten exposures made in this manner. He even referred to his ‘noting the blackness of the lines’ in his introspection on his ninth experience with this series. Evidently, he had set up for himself an *Aufgabe* of noting the form of the exposed letters, and this operated so potently as to exclude altogether a perception of their color.

The effects of the *Aufgaben*, explicit or implicit, are discernible in every cognitive experience described by our observers. In the case of but slightly familiar material, these dispositions served to direct the attention to characteristic features of the stimulus, stimulating the revival of former experiences; they initiated various acts of comparing, contrasting and the like, which culminated in a complete change in the direction of the attention as the act of recognizing was completed. In intermediate stages of recognitions, the operation of the *Aufgabe* is similar to that just described, save that processes between the initial perception and the appropriate reaction are here telescoped or attenuated. At the final stage, the essential characteristic of the cognitive experience consists in the fact that the perception occupies the focus of attention, whence, under the direction of the *Aufgabe*, there is initiated an immediate and appropriate reaction, such as speaking the name of the object recognized, tapping a reaction-key,

¹² This variant was tried on all the observers at the close of the series of visual recognitions.

or making any other bodily adjustment which the circumstances render appropriate.

These processes are followed by a change in the state of the attention. This change consists essentially in a change in the processes which occupy its focus; the observer may turn from the consideration of the stimulus to an introspection of the processes involved in its recognition; or he may abandon the features of the object which have been focal in his activity and note others; or he may cease altogether to employ himself with the stimulus presented or the problem involved, and enter on a wholly different set of activities. The nature of the attention, as well as its direction, undergoes a variation in the moment of identification; *i. e.*, whereas it has been in a state of rapid fluctuation, over a wide range of activities, in that period of relaxation which crowns the recognition, it is now narrowed to a point of exceeding clearness and intensity. The direct product, then, of the awareness of the task is the behavior of the attention. We proceed to a discussion of this fundamental aspect of the experience of recognizing.

b. The behavior of attention. A survey of the experimental data can not fail to establish the fact that the attention exhibits a strikingly characteristic mode of activity during the process of recognition. When one compares a body of introspections such as these experiments have furnished, with introspections on other so-called higher mental processes, such, for example, as judging, willing, abstracting and the like, one is struck by the fact that the contents of all these processes bear a marvelous similarity. It is possible, however, to detect certain differences in the manner in which the content elements of the various processes function.

The introspections of our observers furnish evidence of the fact that the temporal sequence of the processes which follow a perception, their relative clearness, their duration, and the nature of the attention bestowed upon them, manifest certain characteristics corresponding to different degrees of familiarity or mechanization of the process of recognition. These phenomena are the very essence of the cognitive experience. A consideration of the mental experiences described by each of our observers will disclose the facts which have led us to this view.

a. Case Studies of Learning and Recognizing. The results of these investigations show that there is a most intimate relation between the learning procedure and the nature of

the subsequent recognition of the learned experience. In order, therefore, to account for the characteristics of any given act of recognition, it is necessary to study its genesis in the learning process. Such processes exhibit interestingly diverse features in different individuals; and it is with the hope of contributing somewhat to the study of individual differences, as well as to the envisagement of the cognitive experience in process of formation and development, that the following case studies are here appended.

Observer F.

Visual series: In learning the forms of the different faces of type, *F.* invariably fixed his attention on one or two features prominent in the appearance of each, and described them, in vocal-motor terms, throughout the entire exposure-series.

This description was usually accompanied by the name of the type in question,—the whole phrase being sometimes actually whispered, but oftener appearing in vocal-motor imagery; *e. g.*, while learning Clearface type,—a face larger than the others employed, and composed of uniformly heavy lines,—*F.* constantly repeated ‘big, thick Clearface’ in vocal-motor imagery. His position was tense, and gave evidence throughout of his excitement and anxious desire to master the material. The introspections (quoted pp. 324f.) show how persistently this procedure influenced *F.*’s later experiences with this face of type. Another striking instance of such influence occurred in the case of the Bulfinch type. During its initial learning series, *F.* had repeated to himself, ‘This thin, too. Della Robbia thin, *same*; Bulfinch thin, varied’—the obvious meaning of these syncopated phrases, in this setting, being that while the Della Robbia type was composed of fine lines, they were not of the same width throughout any entire letter, while the lines of each letter of Bulfinch were uniformly narrow. Until the very last, this firmly fixed association with Della Robbia persisted. It was the only face with which *F.* ever confused Bulfinch; and long after it ceased to confuse him, the association retained its accustomed place in the sequence of experiences aroused by the Bulfinch type stimulus. In his initial recognitions, *F.*’s attention first seized upon the characteristics of the letter displayed for recognition, and then turned to an active, excited process of describing these characteristics in vocal-motor terms, with momentary pauses after each repetition. If the name of a ‘face’ of type appeared in consciousness, he attended closely to it; the verbal characterization and the name were then

repeated in conjunction. If the excitement abated, and if his attention abandoned this procedure, recognition was experienced, and he reported his identification with certainty. In cases where no such name appeared, the observer was conscious of an active search for one (1 and 2. The second of the introspections here quoted is typical of *F.*'s method of comparing various combinations of vocal-motor cues). In these initial recognitions, *F.*'s attention was occasionally occupied with a recalled visual image of other letters, which he compared or contrasted with the percept which he was endeavoring to identify.¹⁸

As the material became more and more familiar during the successive presentations, processes of comparing the percept with reproduced imagery gradually decreased in number, so that in the several phases of what may be termed the intermediate stage in the mechanization of a recognition, such comparisons appear less and less frequently. In the last of these phases,—a level at which the recognitions may be called 'final,'—*F.*'s attention seized immediately upon the characteristics of the letter displayed, and then turned to a vocal-motor image or verbal characterization, plus the name, *e. g.*, 'funny—Bulfinch.' The problem was then abandoned altogether.

At each of these levels, *F.* was aware of the fact that the stimulus was familiar. Introspectively, he could not abstract this awareness from the succession of processes which appeared in each case. He was conscious of the longer duration of the activities preceding the signal reaction in those cases where he had a consciousness of familiarity.

In the mechanized stage, where no "feeling of familiarity" was aroused, the succession of component processes was still further syncopated; here the appropriate motor response followed immediately upon his attentive perception of the stimulus. No awareness of familiarity or of 'surety' occurs in introspection 4 (p. 325). The distinctive awareness of "known," usually called the "feeling of familiarity," disappeared as the reaction to the stimulus became mechanized. On being asked, in several such cases, if the letter seemed

¹⁸ An illustration of this procedure, which, however, was not typical for this observer, is furnished by the following introspection: March 15, 1913. Bulfinch 'F' "I was immediately aware of vocal-motor imagery: 'It is that funny one, the last one,—funny Bulfinch.' But just before that last phase came in, I had a clear visual image of Bulfinch 'F' and 'E' with their characteristic points, the 'E' being especially clear. Then I was again aware of the exposed letter and I reacted with certainty. Release of tension."

familiar, *F.* replied, 'There wasn't time. I just reacted automatically. Afterwards, I recalled other things about it, and it seemed very familiar.'

Auditory series: *F.*'s method of learning the airs played to him was distinctly different from that which he employed in mastering the visual material. First of all, his attitude was characterized by less strain and anxiety. He was confident of his ability to perform the task set creditably. This statement is based on data of two kinds: 1, the observer's overt behavior, which was marked by an easy, relaxed sitting position, a serene and often smiling countenance, and an absence of verbal or other expressions of discouragement; 2, his introspections, which show that instead of actively seeking associations between the music and its name, he usually listened with enjoyment, often tapping his foot, swinging his arm, or otherwise imitating the rhythm, and frequently humming along with it. The humming was usually in imagery,—vocal-motor and auditory,—though actual innervations were sometimes noted. Visual images of singers, orchestra leaders, dancers and, still more rarely, of musical instruments were aroused from time to time; but though these played a small part in the initial recognitions, they quite disappeared before the mechanized stages had been reached. In learning the selection whose recognitions are quoted (p. 325), *F.* invariably associated with certain bars of it, the words 'Hail, Pennsylvania,'—words which occurred, with the same air, in one of his college songs. As his introspections show, this association invariably played a prominent rôle in his recognitions of the selection.

F.'s initial recognitions of these airs were characterized by an attention which vacillated between the stimulus itself, and imagery of humming the air, or pronouncing its words or name. A consciousness of bodily tension which finally gave way to relaxation, constituted the background of all these experiences. A reduction and telescoping of these processes, and an abbreviation of their duration mark the intermediate stage; while in his final recognitions, *F.*'s attention shifted instantly from the perception of the stimulus to some appropriate motor response, which, in turn, was followed by a sense of relaxation.

Tactual series: In trying to learn the New York Point letter symbols, *F.*'s attitude was very like that which was present in visual series. His attention was narrow, his position alert and tense. His procedure consisted in passing his finger-tips

repeatedly over the group of points composing a given symbol, meanwhile repeating, either in vocal-motor movements or imagery, the name given to the stimulus by the experimenter. The number and arrangement of the points came to his consciousness in terms of tactful and kinaesthetic sensation. He very rarely visualized these stimuli, and visual imagery turned out to be an almost negligible factor in his subsequent recognition of them.

On perceiving the general form of the tactful material, *F.*'s attention, in his initial recognitions, turned to imagery (usually tactful, though sometime visual) of groups of dots, which he proceeded to compare with his present percept. This first stage was never of very long duration, and soon gave place to a type of consciousness in which *F.*'s attention turned directly from the perception of the stimulus to the name which had been associated with it in the past. A consciousness of strain, followed by distinct relief, completed the experience.

Olfactory series: *F.*'s dependence upon vocal-motor cues was strikingly shown in his procedure during the learning of the series of odors. His behavior gave clear evidence of his firm belief that he would succeed very indifferently, if at all; and his introspections give ample testimony of this disbelief in himself. Throughout the presentation of any odor for learning, he sat tense and sniffed vigorously at the stimulus, meanwhile repeating its name, and usually its striking characteristics over and over, in vocal-motor terms,—usually imaginal. For example, in learning Ethyl alcohol, he characterized it thus: "Cool; tickles in *nose*, not *throat*; Ethyl," and this he repeated throughout the exposure. Visual imagery scarcely occurred during this entire series.

The olfactory material furnished an excellent means of observing the behavior of *F.*'s attention in attempting to learn and later to recognize stimuli which had little intrinsic interest for him,—stimuli of a modality in which he believes himself poorly endowed and which furnishes him with few, if any, images.

His initial recognitions describe an awareness of attentively hurrying from the sensation under investigation to repeated reviews of series of vocal-motor images (15). His recognition seemed to depend on the reinstatement of just the proper sequence of images,—that sequence which had been adopted during the learning of the odor in question. This succession of experiences became somewhat syncopated as the odor grew more familiar; but its essential elements remained the same

throughout initial, intermediate and final recognitions. In the introspections quoted (pp. 326f.), *F.*'s characterization of the quality of the odor as 'cool in the nose,' continued to arise in consciousness as the initiator of his identification of this odor. The culmination of this experience of familiarity immediately occurred in the appearance of the odor's name, and *F.*'s reacting signal.

Observer Fn.

Visual series: In learning the visual material, this observer employed visual imagery chiefly, with vocal-motor as his only other imaginal content. During the exposure of the letters of the first type given him for learning, *Fn.* busied himself in noting the form of each letter, frequently calling up a visual image of some letter which had already been noted. When the series had been exposed as far as the letter T, he was aware of vocal-motor imagery of saying, 'I shall call this the ordinary type,—the most natural one.' As other faces of type were shown, *Fn.* constantly found himself calling up images of the letters in faces of type previously exposed, and instituting comparisons between these images and his present percept. He arranged the names of the five types in a visual schema, reading from left to right, in the order in which they had been first presented for learning; and most of his identifications were made by referring, to a given place in this schema, the letter which had been exposed for recognition. The schema was visualized, usually two or three feet to the left of the observer's eye; and the place in it which the type under consideration should occupy, stood out more clearly than the rest of the image. In his final recognitions, either an identification like the one just described took place, followed by the appearance of the name in vocal-motor imagery; or else the name of the type, in vocal-motor imagery, followed immediately upon the visual perception, which was marked by its ease and rapidity.

In the initial visual recognitions of this observer, his attention was attracted first to the size and general form of the letter; then to a rapid series of processes which had to do mainly with comparing and contrasting his present percept with certain images. A very characteristic procedure consisted in visualizing the letter in a definite place in his schema (described above), and then in making an immediate judgment as to whether or not the letter seemed to belong there. Very often, too, *Fn.* called up experiences of former sittings, and proceeded to compare the images thus aroused with the

percept now under consideration. He described the behavior of his attention as being 'sometimes active, sometimes passive,' *i. e.*, he believed he was sometimes aware of an activity and seemed to be directing the course of the processes which he experienced, while at other times he seemed rather a passive spectator of the pageant of his own ideas.

In later recognitions, processes of recall and comparison became fewer, until finally they altogether failed to appear. His attention in these cases behaved in one of two ways: after first seizing upon the characteristics of the letter displayed, it turned instantly either to a definite part of his visual schema, or else to a naming of the type,—the name appearing in vocal-motor imagery or in actual vocalization. The introspections quoted on p. 327 illustrate the changes in the behavior of the attention of this observer throughout the progressive mechanization of his recognitions of one of the faces of type.

In its final form, *Fn.*'s recognition was characterized by what he calls 'its ease and readiness' (21). Such expressions are abundant throughout his introspections, and appear always to signify an explicit mental content,—not an inferred datum. In other words, *Fn.* seemed to attend to the facility of the entrance of a percept into consciousness, as well as to the length of its persistence therein, as attributes of that percept,—components of the total experience highly important to the consciousness of familiarity.

Auditory series: *Fn.*'s learning of the musical selections was an exceedingly active process, rich in sensory components. Floods of imagery, visual, auditory and motor, made their appearance in consciousness. *Fn.* attends to music very analytically; he finds himself noting the phrases in auditory and motor terms, and even in visual imagery of the musical score. He frequently anticipates the phrase or phrases which are to follow.

In his initial recognitions of the auditory stimuli, also, *Fn.*'s attention was very actively employed with images, chiefly visual and auditory, having to do with former hearings of the airs, as well as with visualizations of the present auditory impressions (22). These visualizations consisted in various schemas, in gray symbols which corresponded spatially to the tonal rise and fall of striking phrases in the music. They were often ill-defined and shadowy, yet played a prominent part in *Fn.*'s earlier recognitions of these airs. If the visual schema aroused in consciousness by the selection heard was the one formerly associated with that air, a certain bodily

reaction took place,—the pronouncing of the selection's name; a tap on the reaction-key; relaxation of tension,—any or all of these. But, if some other visual schema arose before his mental vision, these 'familiarity reactions' did not follow, and no certain recognition ensued. In the experience quoted above, *Fn.*'s recognition of the air 'Brautlied' awaited, for its culmination, the repetition in consciousness of the motor reaction (looking in a certain direction) which had formerly been a part of his experience with this air.

Visual schemas played a lesser part in the intermediate levels of his familiarity with this material. In the series of recognitions quoted on pp. 327f., no visualization occurred after the first recognition. In other cases, however, the schemas persisted for various periods of time, sometimes becoming gradually less clear, and sometimes suddenly dropping out of the experience altogether. Revivals of past experiences and comparisons of them with the present stimulus were common at this stage of the experiment.

The final type of auditory recognition described by *Fn.* consisted in a rapid attentive perception of certain characteristics of the stimulus, followed immediately by a unique bodily reaction—a pervasive thrill, which seemed to be essential to his consciousness of familiarity (24) and to which he seemed always to attend.

Tactual series: In learning to recognize tactual stimuli, *Fn.* had recourse chiefly to visual imagery. His method consisted in obtaining a clear tactual and kinaesthetic perception of the number and arrangement of the dots, and then in visualizing that arrangement. Very little vocal-motor or auditory imagery was reported in any of his introspections on the learning of the letters, although the former made up a large part of the structure of his recognitions later on. *Fn.* reported more tactual and kinaesthetic imagery in his recognitions than did any other observer. He frequently remembered his former experiences with these letters in terms of kinaesthetic and tactual imagery; and, employing these same terms, he frequently anticipated the sensation which was about to be experienced when only a part of the stimulus had as yet been explored. Visual imagery is the most important structural component in the cognitive consciousness of this observer.

In his recognitions of the tactual material, we find *Fn.*, in the initial stages, attending actively to comparisons and contrasts between his perception of the presented touch symbols, and his revived imagery, both tactual and visual, of these experiences (25). Here again, visual schemas appear, in

which the letters were arranged in the order of their first presentation in the learning series. If, on the appearance of the visual image of such a schema, a given portion of it claimed his attention and stood out clearly, *Fn.* localized a visual image of the symbol which he was actually examining with his finger tips, in that portion of the schema; and his consciousness of familiarity was then intensified by an appropriate motor response.

As in the case of the auditory material, the visual schemas dropped out during the intermediate stages of mechanization; and thereafter his attention was less and less occupied with revivals of past experiences, though such processes still were a part of the recognitions at this level (26, 27).

Even in its final, or most nearly mechanized form, *Fn.*'s perception of a touch symbol was always attended by a visual image of the letter which it represented. In his recognitions of exceedingly familiar touch sensations (28), no revival of past experiences appeared. He invariably reported that he attended merely to some characteristic quality of the stimulus, to an awareness of the rapidity with which it came to consciousness: the 'permanence' of the character noted; and to the diffuse bodily thrill which ensued.

Observer Fs.

Visual series: *Fs.* employed both visual and vocal-motor imagery in her learning of these faces of type, often calling up visual images of other letters as the alphabet was being presented, and frequently characterizing letters, in vocal-motor imagery, as 'heavier,' as 'too fine,' etc. Her characteristic motor tendency in dealing with new material,—that is, her tendency to trace its form with the tip of the tongue against the back of the teeth,—was present in many cases.¹⁴ Revivals of that tendency were observed in many recognitions of the same material. But by far the majority of all her recognitions included a reference to a visual schema which *Fs.* had built up during the first sitting. She described it as "five gray blotches which might be letters, located in a vertical column. They represent for me the names of the types in the

¹⁴ The following introspection shows this process operating in a very interesting fashion. Bulfinch type had just been displayed in a learning series. "First I noted that this was a heavier type than the last. Then, with a great deal of satisfaction, I noted that I was getting a series of letters which had straight lines, of which the one on the right was always heavier. This came to consciousness in tongue movements. My tongue outlined the light lines with a slight pressure against the teeth, and then the heavy lines with an energetic stroke."

order in which they were presented the first time (Della Robbia, Bulfinch, American Typewriter, De Vinne, and Clear-face). When the first place demands my attention and grows clearer, the name 'Della Robbia' appears in consciousness, immediately, in vocal-motor terms, etc." This schema became much less detailed in the later recognitions, where, indeed, it sometimes failed to appear.

When letters which had only a slight degree of familiarity were presented to *Fs.* for recognition, her attention busied itself first with a minute scrutiny of each formerly noted characteristic of the letter; next, it usually turned to an attempted recall of each face of type which had been employed in the experiment. This recall sometimes took the form of attending to vocal-motor imagery of the name of the type-face; but the moment the name appeared in consciousness *Fs.* found herself attending to the appropriate place in her visual schema of the five gray blotches, each associated with the name of one of the faces of type (29). She frequently visualized some letter of each type in its proper place in the schema, and compared its size and characteristics with those of the letter actually displayed for recognition. Sometimes the visual schema appeared in consciousness immediately upon the noting of the letter displayed; and then her attention turned to a naming of the various parts of the schema. So long as her attention was occupied in this manner, *Fs.* was uncertain of her identification of the letter under consideration; but when this activity ceased, when her attention paused for a perceptible time on some one position in the schema or on some one name, which then became clear, a final turn of attention from the problem served to make the recognition complete and certain.

As the material became more familiar, there were naturally only two or at most three possible identifications which engaged the observer's attention. There was often a confused state, a consciousness of strained activity, with some recall and comparison. Sometimes a number of images, more or less clear and detailed, occupied her attention momentarily, only to drop out of consciousness when that insignificant pause in the activity initiated her identification (30).

Finally, when perfectly familiar material was presented, *Fs.* found her attention leaping from a group of the main characteristics of the letter,—or from a perception of the particular feature which was for her a cue,—to the name of the face of type to which it belonged, or to the tap which signified her identification of the letter. The introspections (quoted

on p. 329) illustrate the typical behavior of the attention in the case of this observer, at various stages in the experiment, with visual material.

Auditory series: In the case of the auditory material, the same characteristic differences appeared in the behavior of her attention when stimuli of different degrees of familiarity were presented. When relatively new airs were played, *Fs.* found that she had attentively compared or contrasted the auditory impression with images of airs formerly heard. Visual schemas (38) and other visual images were abundant. Various names of selections played during the experiment came to consciousness, some appearing only to disappear immediately, others persisting and claiming the attention for a longer or shorter time. The turning of her attention from a name to a motor reaction (either of pronouncing it, or of tapping the key) completed her act of recognizing the air. The intermediate stages of familiarity were marked by syncopation of all these processes.

In her final recognitions, *Fs.* was conscious of an attentive noting of the stimulus, followed by an awareness of rhythmic kinaesthesia, variously localized, and an immediate tendency to tap the reaction-key. The manner in which her attention turned from clear perception to appropriate reaction, with only the slightest pause or inhibition, constituted her consciousness of familiarity with the given air (37, 39). When absolutely no pause of process intervened, the characteristic 'feeling of familiarity' did not arise.

A striking confirmation of the dependence of recognition on a particular attention-sequence is found in the behavior of this observer's attention on several occasions when new airs were introduced in certain control experiments. For example, her awareness of unfamiliarity with a portion of *Tra-viata* (40) consisted in a persistence of attention to the stimulus and a vocal-motor auditory 'new.' Rhythmic kinaesthesia was present, and even an automatic reaction-tap; but there was no recognition *Aufgabe*, and no characteristic shift of attention. In other words, her attention had not behaved in the manner customary to the act of perceiving old stimuli, and the experience of non-recognition ensued.

Tactual series: Similar functioning of the attention marked various stages in *Fs.*'s consciousness of familiarity with the tactual material. In learning the touch symbols, *Fs.* made constant use of visual and vocal-motor imagery, actually visualizing the points as raised dots, which seemed to appear

on a white background.¹⁵ She frequently visualized, also, the letter which a particular combination of dots represented, this image usually appearing in the form of a printed letter, just above her visual image of the dots themselves. The name given the stimulus by the experimenter was repeated by *Fs.* in vocal-motor imagery; and frequently some characterization of the arrangement of the points came to consciousness in the same terms.

Another learning method in which a motor cue was the essential feature is illustrated in her experience with the symbol for "f," which consisted of three dots in a horizontal row. She associated this with the deaf and dumb manual symbol,—passing one palm over the other. Motor imagery of this gesture was always a component of her experiences with this particular symbol.

In the initial stages, her attention was actively concerned with memory imagery, as well as with the characteristic features of the present stimulus. The consciousness of strain and of activity she called 'a persistent whiteness'; it initiated her awareness that the stimulus was one with which she had previously dealt (41). This plan of active searching, image-evoking, etc. (42), became less prominent as her familiarity with these tactful letter symbols increased. Motor cues became more important in the intermediate stages; and finally, in the most nearly mechanized recognitions obtained in this series, her attention turned instantaneously from an active noting of the stimulus to some representative idea (visual or motor) of its form, and then to an appropriate motor reaction (43). The latter consisted sometimes merely in the signal-tap; but more often it took the form of a pronouncing of the name of the letter whose symbol was being investigated.

Olfactory series: When she was given an odor to learn, *Fs.* was entirely absorbed, at first, in attending to its smell quality. She endeavored to single out some unique characteristic which should serve later as a means of identification. This procedure she described, again and again, as consisting in repeatedly inhaling deep draughts of the odor and attending narrowly to its qualities. She often visualized the odor's name (which was pronounced aloud by the experimenter); and in case of what she called "flower perfumes," she frequently had visual images of flowers, perfume bottles, etc. Occasionally, the learning consisted merely in associating the

¹⁵ These letter-symbols had been presented only in tactful fashion. The observer was blind-folded throughout, and she never at any time *saw* the group of dots.

vocal-motor auditory image of the name directly with the odor quality. In some of her early experiences with the "non-flower odors," she constructed a visual schema, not unlike that employed in her visual series, in which each gray blotch was associated with the name and the odor originally presented in an order corresponding to the series number of the blotch in question.

Her overt behavior suggested that she considered the game an interesting one, and that she viewed her own performance quite objectively. There were no signs of discouragement, impatience or anxiety.

In this observer's initial recognitions of the odors learned in this experiment, her attention was divided among many claimants. The first perception of the stimulus seemed to initiate a flood of recalled experiences, chiefly of a visual and vocal-motor auditory sort, having to do, usually, with past sittings in the experiment. An examination of the introspections quoted from this series (pp. 332ff.) shows that the certainty of a recognition bears an inverse relation to the multiplicity of processes which intervene between the perception of the odor and the reaction thereto. Her second introspection (45) contains an excellent confirmation of our contention that the essence of the consciousness of familiarity consists in the sequence in attention of processes beginning with an *Aufgabe* to recognize, proceeding to a clear perception of some distinguishing characteristic of the stimulus, and passing, after pause and tension, to an appropriate reaction. The odor of Trèfle was clearly recognized first as a perfume in just such a sequence of processes, though it was not yet familiar enough to be known as the particular fragrance called Trèfle.

The fourth introspection of this series (47) is typical of the initial olfactory recognitions of *Fs*. Here, though her attention takes the general course shown in her learning procedure, still much imagery intervenes between perception and reaction; and the result is a lack of certainty even when the correct name for the perfume finally appears.

During the intermediate stages, these associated and irrelevant processes become fewer, and less compelling to her attention (48); and by the time an odor has become exceedingly well known, such processes have disappeared altogether. We have then a rapid, sure recognition, whose essence consists in the movement of the attention, directed by the *Aufgabe*, from unique stimulus quality to appropriate reaction (49).

Observer W.

Visual series: Visual, vocal-motor and auditory imagery were almost equally important for *W.* In his attempts to master the visual material,—visual imagery being slightly favored. Every detail of each letter was noted in clear visual perception. His visual imagery consisted chiefly in revivals of letters which had formerly been presented, sometimes of the same, sometimes of different types; in retaining in memory the letter last presented (when an entire alphabet was being displayed) until the next appeared; and often in anticipating certain of the letters which were still to be observed. During the progress of these visual activities, *W.* was aware that he was describing certain characteristics of the types in vocal-motor and auditory imagery, frequently repeating, in these same terms, the name of the type which was being presented.

The attention of this observer is characterized throughout by its mobility. In his initial recognitions, with the first noting of the characteristics of the letter presented, *W.* found that his attention had turned with great celerity to a constantly shifting mass of imagery and affective toning, and that multiple activities such as comparing, discarding, accepting, contrasting, and the like, succeeded each other with kaleidoscopic rapidity. All of these activities he described in terms of kinaesthesia and attention. For example, a typical case of the activity of contrasting occurred when a De Vinne 'A' was presented and *W.* found himself attending to a hazy visual image of larger letters from which the stimulus letter seemed to emerge. This, together with a faint vocal-motor 'small' was for him a consciousness that the letter under consideration belonged to a type-face which was smaller than any other shown him during the investigation. *W.*'s awareness of these particular activities of attention,—turning now to this, now to that image, with well-defined strain, often localized in the vocal-motor apparatus,—constituted for him an experience of familiarity with the material (50). This experience was usually, though not always, affectively agreeable. In his subsequent recognitions, *W.* found that his attention was less and less occupied with revived imagery, comparisons, and the like, and that it tended to turn more quickly from the characteristics of his percept to some sort of motor reaction (51). This latter usually consisted in the actual pronouncing of the name of the typeface to which the letter belonged. The moment which immediately precedes this turn-

ing from the percept was characterized by an awareness of tension in the head or upper body, and by a sudden rise in the intensity of the impression, or,—as *W.* frequently phrased it,—by a ‘consciousness of increased attention to the percept, followed by a relaxation and a complete shift of attention away from it, and toward the vocalization of something.’ This ‘something’ proved to be, usually, the name of one of the type-faces, although the type was not always named correctly even when it had been recognized as very familiar. The awareness of the functioning of the elements concerned,—of the increased tension, the relaxation and the attention shift,—constituted the essentials of the recognition (52).

Auditory series: In learning to recognize the musical selections, *W.*’s consciousness was rich in sensory components of great clearness and detail. He usually reported visual imagery of an orchestra, or of certain instruments from which the music seemed to proceed; and he was frequently conscious of visual imagery of printed music. Remembrances of other airs, in auditory and vocal-motor terms, frequently appeared, as well as motor imagery of singing the selection which was being presented. Kinaesthesia was exceedingly important; it usually consisted of innervations of the muscles of the hands, arms, face, neck, feet, legs and chest,—their order of importance following the order named. Occasionally, kinaesthesia functioned as the only sensory component in his recognition consciousness.

In his recognitions of the musical selections, *W.*’s attention exhibited the same general course of activity as that just described. In the earlier recognitions, while the airs were as yet only slightly familiar, it was occupied with groups of imagery and kinaestheses, groping amid multitudinous details of present and recalled experiences until some appropriate motor response ensued. When such reaction finally occurred, *W.*’s attention instantly shifted,—turning from both the stimulus and from his recent reaction thereto (53).

As the airs became more familiar, the number of activities engaging his attention became proportionately less, though here, as always, the general course of his procedure was the same, from the noting of certain characteristics of the stimulus, to some appropriate reaction to it (54).

Finally, when a very familiar selection was played, *W.*’s attention hurried from a strained noting of some striking feature of the air, of the rhythm or of his concomitant vocal-motor auditory imagery, to his usual reaction to the familiar air, complete relaxation ensuing (55).

Tactual series: *W.* employed little imagery other than visual in his learning of the New York Point letters. His perception of the number and arrangement of the points was obtained by means of tactual sensations, sometimes supplemented by kinaesthesia in the finger or forearm,—when he actually moved his finger over the points repeatedly and always in the same direction. The perception thus obtained was succeeded by an instant visualization of a group of dots of definite number and arrangement, and, usually, the letter for which they stood appeared beside the dots in the visual image.

In his earlier recognitions of the tactual material, besides rapidly noting and comparing the percept and the associated visual images, *W.*'s attention frequently shifted to a very complete reconstruction of one or more of the letter symbols which had been formerly presented to him (57).

As the letter symbols became more familiar, there was less recall of past situations. However, a clear visualization of the arrangement and number of points, as well as of the letter which these points represented was a necessity throughout the intermediate stage of the mechanization of the act of recognizing these symbols. The introspections show, too, that the decrease in the number of processes making up these intermediate recognitions was in the nature of a telescoping of those originally present, as the general course of events tended to remain constant throughout subsequent experiences with any given letter symbol (58, 59).

It was only in his mechanized recognitions of these materials that no visual imagery of printed letters made its appearance. Here, his attention hurried from the noted characteristic of the tactual stimulus to a pronunciation of its name. *W.* describes this experience as so thoroughly mechanized that he was not conscious of any familiarity with the given stimulus,—the reaction seemed entirely automatic (60).

Olfactory series: *W.* took up a rather passive attitude in his learning of the olfactory stimuli. Like *Fs.*, he seemed to find his experiences interesting and abandoned himself to them in a manner which seemed to give them, in marked degree, the spontaneity and naturalness so earnestly striven for in laboratory procedure. During the smelling of the odors to be learned, his consciousness was rich in imagery of many modalities, the visual predominating. His visual imagery was very profuse and varied. Certain images came to be permanently associated with certain odors, as, a clover field with Trèfle, a pot-pourri with Rose. Auditory and vocal-motor imagery of names and characterizations of the odors were

also abundant; and olfactory imagery was present with surprising frequency.

The most unique and characteristic thing connected with *W.*'s learning of these stimuli, however, was his tendency to localize certain odors in certain definite parts of his nose. Each, too, had its own tactal qualities. Thus, Coast Violet 'strikes low in the nostril, and is smooth and oily'; Amyl alcohol appeared to be experienced 'far back, and down in the throat'; *Quelques Fleurs* is 'a diffused, prickling sensation, high in the nose'; Ethyl alcohol is a 'vapor-like and watery cone which seems to start low in the nose and then to spread out.'

In learning the Coast Violet perfume, recognitions of which are quoted (pp. 336ff.) *W.* invariably perceived the pungency of the sensation in visual and tactal terms, which he described 'as visualizing the lower part of his nasal lining, which seemed to be smooth and oily.' Visual imagery of a meadow, in which plants like skunk-cabbages were growing, was also present whenever this odor was given him.

Familiarity with an odor, in *W.*'s case, was always the result of a definite sort of attention behavior: a movement in the direction invariably followed in learning the material, from *Aufgabe* to characteristic feature, thence to some striking association,—usually of a visual order,—and finally to an appropriate motor response. The latter, in this series, was often non-focal, in which case the attention had withdrawn from the problem and turned to something else, *i. e.*, the introspection, the situation, etc.

In recognitions of the initial sort, the experience was very complex; and associations and activities of many kinds found their way into the stream of attentive processes. In proportion to the interruption and delay thus caused, surety of identification became less, though the experience of familiarity was often unaffected thereby. Let the order of associations be disturbed, whether by the interference of images not formerly a part of the experience with the odor under examination, or by sensations of a new character (64), or by the absence of some important element, and the odor might not be identified at all, or might cease to seem familiar.

The dropping out of the less important elements of the original sequence of processes, did not lessen the intensity of the experience of familiarity. This is exactly what happened in the recognitions which we call intermediate (65).

In the final stages of these recognitions, the attention was still much more occupied with imagery than was the case in

any other of the materials used (66). The essential thing to note in these experiences is the movement of the attention activity from stimulus quality to reaction, the time interval between becoming less as mechanization proceeds.

Observer V.

Auditory series: During her learning of the musical selections, *V.* was constantly aware of visual imagery of unusual detail, color and variety, as well as of much emphatic inner-mentation and imagery. The visual imagery included detailed representations of orchestras, of particular instruments, of stages set for opera, and the like. In many instances, the clang-tint of a particular instrument was represented in her consciousness by symbolic imagery sometimes accompanied by empathy. For example, the clang-tint of a bass horn in the Tschaikowsky Symphony was represented in her consciousness as a large, formless, dark, smooth mass; and accompanying this imagery was a unique experience which she described as a feeling that her own body was being expanded and diffused.

The temporal sequence of the events which occupied the focus of *V.*'s attention, together with their nature and duration, was a very important factor in each of the several stages of her consciousness of familiarity with this auditory material. In the initial stage, she was first aware of attentively noting the stimulus,—the clearness of her perception of it constituting one factor in her consciousness of its familiarity. Then her attention was attracted to kinaesthesia and organic sensations; these almost invariably consisted in internal imitations of the rhythm, and constituted her perception of that rhythm. If no name for the selection yet appeared and claimed her attention, the latter was occupied with a renewed noting of the stimulus. This stage was frequently characterized by the presence of associated imagery, which was dominantly visual (62). Some appropriate motor reaction ultimately ensued,—its implicit suitability consisting merely in the fact that on its completion her attention withdrew completely from the problem and turned to an introspection of the processes which she had just experienced.

As her recognitions became more rapid and sure, *V.*'s attention was occupied with fewer remembrances of her former experiences with the selections, though striking visual images associated with an air tended to persist and to occur in the same sequence of events throughout (68). Her attention

came more and more to shift from an awareness of a satisfactory adjustment to it, followed by organic sensations of relaxation (69, 70). The latter form of procedure is characteristic of the final form of her experience of recognition.

Tactual series: During her learning of the point letters, *V.* was actively engaged in obtaining tactual and kinaesthetic impressions of each stimulus presented, and in instantly visualizing each in turn.

V.'s experiences with the tactual stimuli were characterized by an attention behavior similar to that described in her auditory recognitions. In her initial experiences, while the stimuli had as yet no high degree of familiarity, she reported a keenly active attention, occupied with obtaining a clearer perception of the stimulus presented, and with a visualization of certain characteristics of that perception. Complete certainty, however, was not attained until a name for the stimulus was pronounced. In the intermediate stages of mechanization, her act of recognizing was characterized by a somewhat less active attention, engaged with fewer processes; a name for the stimulus here became focal more rapidly. Finally, when the touch symbols had become thoroughly familiar, *V.*'s attention leaped from her tactual perception, with its accompanying tension, to an almost instantaneous kinaesthetic relaxation,—this sequence of attentive processes constituting her consciousness of familiarity with the stimulus. The subsequent appearance of a visual image of the letter whose symbol had been presented was entirely incidental to the act of recognizing (73).

Olfactory series: *V.*'s learning of the odors was characterized by an eager, interested attitude. She remembers odors readily, and they are, for her, usually rich in associations. The affective toning possessed by certain of these stimuli proved to be a great aid in her later identification of them. Her procedure in learning the perfume called *Quelques Fleurs* is typical and I can do no better than to quote her description of it:

"In the fore-period (*i. e.*, between the pronunciation of the perfume's name and its presentation) I was visualizing the name written in Japanesey letters, and pronouncing it to myself. I also had a visual image of 'Some Flowers,' printed in bold type. When I got the odor I experienced, first, a marked degree of pleasure. Then my attention turned to a visual image of a bunch of wild flowers, violet and pink in color, with pale green leaves,—held tightly in a small hand.

I saw the tiny fingers but no thumb, and was aware of smiling with great pleasure. Then I attended to the stimulus again, but the odor seemed to take me to a forest path, with big, cool tree trunks, and large sweeps of green. It was all very pleasant. I ended by saying 'Quelques Fleurs' several times."

In all her recognitions of the odors, *V.* attended chiefly to the affective toning which each of the different stimuli aroused. In the earlier experiences with a given stimulus, her attention was next attracted to a succession of images such as had constituted her experience in learning the particular odor under consideration. These images, chiefly visual, often underwent considerable condensation and displacement. For example, color, which was associated with a bouquet in learning, sometimes appeared in a recognition merely as tinting the letters of a verbal image of the perfume's name (74). In intermediate stages, such associated imagery frequently occupied her attention for only the briefest instant, and then often in mutilated, abbreviated or embellished form. The essential thing here, as in every level of familiarity, was that the attention followed a given procedure,—passing from percept through emotional toning to appropriate reaction, under the direction of a recognition *Aufgabe*. In the final stage, no processes intervened between these salient features of the experience (77).

*Observer B.*¹⁶

Auditory series: *B.*'s attention, in his earlier recognitions of the musical selections, was, like *W.*'s, first occupied in noting various characteristics of the stimulus and in comparing them with imagery of his former experiences with the same stimuli. Motor and organic phenomena occupied a prominent place in his attention activity, as also did various visual schemata (81). Kinaesthetic experiences of swaying, beating time, and the like, were frequently focal in his attention; and when present they invariably constituted an important factor in *B.*'s consciousness of familiarity (78). In his later recognitions, *B.*'s attention was less frequently occupied with remembrances of his former experiences with the musical selections. His recognitions during the intermediate stage were almost invariably characterized by the fact that kinaesthetic and organic sensations occupied the focus of attention; and these sensations were usually accompanied by anticipatory images of the air, in auditory terms (79).

¹⁶ *B.* served only on the auditory series.

In his final experience, however, *B.*'s attention first seized upon the clearness and facility of his perception, and then turned to his customary response (80).

*Observer O.*¹⁷

Olfactory series: *O.* doubted his ability to learn the odors used in the olfactory series, and both his overt behavior and his introspections testify to a certain strain and anxiety in his attitude. He succeeded in mastering only a few of them. Vocal-motor imagery and affective toning proved to be his best aids to identification, and he attended to them, almost exclusively, during both learning and recognizing experiences.

The course of *O.*'s attention at different levels in the mechanizing of his recognitions of a given odor needs no special comment. An examination of a typical series of his introspections (pp. 340f.) reveals a procedure like that already described in the cases of all the observers. His early recognitions are less rich in associated imagery than are those of many of our observers, but so also are his learning experiences.

Observer S.

Olfactory series: *S.*'s attitude in these experiments on smell recognitions was that of one intent on an interesting and pleasant activity. He is convinced that olfactory images are common in his experience and even make up a large part of his mental life. He remembers odors readily, and finds them very potent in arousing associations.

His learning of the odors consisted in associating their names with the particular sensations and feelings which they aroused; and this process was invariably attended by detailed visual and vocal-motor imagery. Cresol, for example, was marked in his consciousness by the fact that the odor seemed always to affect a particular part of his nose, in a particular way, all of which he visualized. He noted, also, that its smell quality persisted longer than was usual with the other odors of the series; and this experience of duration seems to have been a very definite conscious datum,—an attribute of the sensation in question (85). On its first presentation, he experienced detailed imagery of a bottle of Mapleine, and of the odor of maple sugar.¹⁸ Revivals of these images, in various degrees of integrity, persisted into the later stages of his recognitions of Cresol.

¹⁷ Observers *O.* and *S.* and *Bd.* served only in the olfactory series.

¹⁸ See footnote, p. 341.

In the initial experiences, *S.*'s attention was engaged not only with the location and persistent quality of the sensation, but also with detailed revivals of visual and other images which had been associated with the Cresol odor during the first learning presentation (85). As the odor became more and more familiar, this imagery became telescoped, abbreviated or lessened in amount; when the odor had become exceedingly familiar, no imagery remained. *S.* found his attention first occupied with the persistence of the peculiar tactal and olfactory qualities of the sensation, and noted the passing, with slight pause, to a motor response. In the particular case quoted, this response consisted in speaking the odor's name. A motor response of a different kind and one often described by *S.* as largely constituting his awareness that the stimulus was a familiar one, consists merely in a sudden inhibition of his inhalation of the odor.

Observer Bd.

Olfactory series: Bd. approached the problem of learning to identify odors with considerable misgiving. He was unaware, when the experiment began, that he ever experienced olfactory imagery; and he was of the opinion that he would be slow in learning the odors presented. He took up a very active attitude during each sitting,—an attitude which was dominated by his keen awareness of the task. Here is his own description of his typical learning procedure:

“ I am very clearly aware of an *Aufgabe* to remember definite characteristics of each odor. This is present in vocal-motor terms; I sometimes feel myself tending to say ‘very definite characteristic,’ but in very much abbreviated form.”

In learning the perfume called Halcyon Rose, recognitions of which are described in the introspections quoted (pp. 342f.), he says:

“ I was aware of very keen concentration of attention upon the task in hand, and of the *Aufgabe* to identify the odor, which was present in the word ‘identify’ appearing, with a rising inflection, in vocal-motor imagery. I noted the characteristic of the odor, that briar-rose quality, and tended to repeat ‘briar’ and ‘rose’ during the sniffing.”

In his initial stage of familiarity with any of the odors learned in this series, *Bd.* described partial or complete repetitions of his former experiences with the odor in question. He found his attention moving from event to event, in the

sequence which had formerly obtained. Moreover, he reported not only awareness of the succession of sensory and affective components, but also a consciousness of the nature of his attentive activity. 'I was aware of very keen concentration' is a very common phrase in his introspections; so also are descriptions of 'actively waiting,'—a state which he believed was something over and above the muscular tension involved in both.

The intermediate and mechanized stages of *Bd.*'s familiarity with this material was marked by a decreasing temporal duration, a lessening of the strain and of the searching activities. In the final stages, especially, the sense of familiarity welled up immediately (95, 96) upon his perception of the odor quality,—his attention turning almost instantly to a motor response. He again and again described his 'feeling of familiarity' as a 'complex of organic sensation and kinaesthesia, pleasantly toned, not localized at any particular point, but chiefly about the chest and upward.' The introspective evidence shows that such states are always preceded by a consciousness of the recognition-task together with a perception of sensation quality, and that they are succeeded rapidly by relaxation and shift of attention.

β. Conclusions. A survey of the introspective evidence, and of the foregoing discussion of the conscious processes which they record, leads to the following conclusions.

The mental behavior peculiar to the act of recognizing is invariably induced by a certain attitude which may be called a 'preparedness to recognize.' This attitude is the immediate result of the task set the observer. Under our experimental conditions, he was instructed to attend to the stimulus, and to decide whether it was known or unknown to him. After the first sitting, the act of merely placing himself before the apparatus was sufficient to induce a recognitive attitude. The observer was often keenly aware of this preparedness, especially in the period immediately following the 'ready' signal; and many descriptions of its structural content were given. It frequently took the forms of vocal-motor processes such as, 'What *is* it?' or, oftener still, a telescoped form of the first word only,—'Wha?' Consciousness of diffused bodily strains; awareness of the hand poised above the reaction-key; tension in the vocal-motor organs, as though about to pronounce a name; visual imagery of the experimenter's face wearing an expectant look,—these and many other processes were again and again reported as components of the consciousness of the task,—or as its entire and adequate sensory content.

When a known stimulus was presented, the preparedness to recognize, explicit or implicit in the activity itself, induced a behavior of attention which was characteristic of the cognitive consciousness. When the stimulus was presented, the attention immediately fastened upon distinctive features, or upon a distinctive feature, which had been noted previously. If the stimulus was still relatively unfamiliar, the attention was next occupied with revived associations; and it fluctuated between these and farther notings of characteristics of the stimulus, until its name appeared in consciousness, or until an appropriate reaction was made. The duration of the experiences constantly decreases.

As the stimuli grew more familiar, certain of these associative activities and components dropped out, until finally, not even the name remained necessary for complete recognition,—the appropriate reaction following immediately upon the clear perception of certain characteristics of the stimulus. Three components of the cognitive experience, however, were invariably present in orderly sequence: the preparedness to recognize; the clear perception (more or less prolonged) of some characteristic feature of the stimulus; an appropriate reaction. The absence of any one of these components, or a change in their order of appearance resulted, invariably, in an absence of the experience of familiarity. This particular behavior comprises a sequential, synthetized experience which is the consciousness of familiarity.

γ. Summary

1. The process of recognizing, whose essence is an awareness of familiarity, exhibited many degrees of complexity, among which at least three well-marked stages or levels were distinguished.¹⁹

2. Each of these three levels, which may be called initial, intermediate and final, was characterized by a mode of attention behavior which, though showing certain features common to all the stages, was nevertheless unique in certain particulars.

3. At all levels of familiarity, the attention was under the dominance of a recognition-*Aufgabe*,—a task ‘to recognize.’ This *Aufgabe* was often consciously present; sometimes it was implicitly present in the mode of the activities which devolved and in the reaction which completed each experience.

¹⁹ We do not include here the level of complete mechanization, where reactions to stimuli are automatic and instantaneous, and where no awareness of familiarity is present.

4. At all levels of familiarity the attention moved, under this domination of *Aufgabe*, in a given sequence from clearly perceived stimulus through appropriate reaction to relaxation and shift of focus. This is, also, a complete description of its behavior in the final stage of familiarity.

5. In the initial stage, the attention was characterized by the fact that it dwelt longer on the stimulus quality or qualities perceived, and in that it was next claimed by acts of comparing, contrasting, rejecting and the like, having to do with revived imagery and present percept. These acts were interpolated, in the sequence described above, between the initial perception of the stimulus and the appropriate reaction.

6. In the intermediate stage, which itself often included varying numbers of levels, each marked by differences in duration and complexity, the attention to the stimulus and to processes subsequently aroused was of shorter duration. Furthermore, the processes which claimed attention became progressively fewer and more syncopated.

7. The awareness, or 'feeling' of familiarity is not a moment of consciousness, immediate and static; it is a progressing consciousness, made up of definite sequences, and including an awareness of the temporal duration of the processes preceding the motor reaction appropriate to the stimulus.

8. The actual magnitude of this temporal duration bears no constant relation to the intensity of the experience of familiarity, which requires merely that a *perceptible* time interval shall intervene between perception and reaction. When no such duration attribute is present to consciousness, an appropriate reaction to the stimulus may take place without the arousal of any "feeling of familiarity."

9. The degree of familiarity, as measured by ease of identification, bears an inverse relation to the time consumed in recognition.

C. Structural Components of Recognition.

a. *Sensory components.* It has already been stated that this study has demonstrated the existence of different stages or levels of familiarity, each of which is characterized by certain functional traits. Structural differences are also apparent. Obviously, since recognition is an awareness built up through successive experiences, there are no constant or sharply defined lines of separation between the stages here named and described; yet their characteristics are distinctive and have, it would seem, an important bearing on the traditional controversy as to whether or not recognition is an imageless

process. If our results have universal validity, the act of recognizing may be imageless, but may not be devoid of both imagery and sensation; and the more mechanized the process becomes, the nearer it approaches a non-sensory content. Those investigators who find that imagery is always present in recognitions would seem to have examined recognitions only in the initial or in some intermediate stage of mechanization. Such recognitions, obviously, are exceedingly numerous and important; but they by no means exhaust the possibilities of cognitive experience.

In our discussion of individual cases, under the heading of functional components of recognition, a somewhat detailed account was necessarily given of the structural components which were present in the cognitive experiences of each observer at different levels of his increasing familiarization with the stimuli employed. We refer the reader to these analyses and to the typical introspections quoted from the protocol of each observer, for confirmation of the following conclusions regarding the sensory components of the process of recognizing.

When stimuli having only a slight degree of familiarity for an observer were presented to him, his consciousness was rich in sensory components. He was aware not only of the sensations aroused by various aspects of the stimulus itself, but of a varied mass of images and sensations, sometimes affectively toned, and usually having a direct connection with his former experiences with the stimuli in question. The sort of imagery which was most abundant and detailed in such experiences seemed to be that favored in the imaginal type of the observer, rather than that of the sense modality to which the stimulus belonged.

We offer this latter point merely as a suggestive probability, —for no thoroughgoing tests to determine the imaginal types of our observers were undertaken. Such tests would have been a problem in themselves, as Fernald²⁰ has amply demonstrated. The imaginal type of each of our observers was roughly diagnosed from data at hand, obtained in numerous experiments in the Clark laboratory, where all had been working for periods ranging from one to four years. According to this classification, *Fs.*, *B.*, and *S.* were of the balanced type, using imagery of several modalities with equal facility; *W.*,

²⁰ Fernald, M. R., "The Diagnosis of Mental Imagery," *Psychol. Monog.*, 1912, XIV, I, p. 169.

V., and *Fn.* were of the mixed type, with marked preference for visual imagery; *Bd.*, *F.*, and *O.* were of the mixed type, with preference for vocal-motor imagery. *F.*'s vocal-motor preference is especially marked.

As the experimental materials became more and more familiar in successive presentations, there was a signal decrease in the amount of imagery present in the cognitive experiences. Its details, also, tended to be lessened and there were frequent examples of noticeable decay or alteration in the revived images which appeared. In some cases interesting condensations occurred, details of several images being fused into one. Organic sensations and kinaesthesia became more prominent in these mechanizing stages and the time required for each recognition grew notably shorter. Finally, when the materials were so well learned that their recognition was certain and immediate,²¹ sensory content, though still present, was usually reduced to its lowest terms: an appropriate bodily reaction, often merely organic and kinaesthetic tension and relaxation.

b. Affective toning. It has long been maintained that pleasant affective toning is an indispensable component of the process of recognizing. A formidable list of psychologists supports this view.²² James likens this pleasurable feeling to the warmth experienced on meeting an old friend. In the case of meeting, in a dark alley, a well-known enemy, this position would surely have to be defended by assuming that the glow of pleasure which is necessarily a part of the recognition is still present, but is quite swamped in other feelings aroused by this known object. In other words, the pleasure was there, but could not be felt! Happily, experimental evidence makes such logical assumption unnecessary. Affective toning appeared in less than forty-five per cent of the fifteen hundred recognitive processes analysed during these experiments; and in three per cent of these cases, the feeling was unpleasant.

Pleasantness often appeared as part of the consciousness of having successfully performed the task assigned. It also accompanied many sensations aroused by the stimuli, whether or not they were known. This was especially true in the auditory series, and in the cases of certain of the perfumes

²¹ The term 'immediate' is used in its relation to the time required, and not in the sense of 'underived.'

²² Cf. among others: Wundt, 58, 536; Külpe, 56, 172; Titchener, 57, 408; James, 54, 650; Meumann, 21, 40; Katzaroff, 55, 75.

used in the olfactory experiments.²³ Pleasantness was entirely lacking, however, in a great proportion of the recognitions described by our observers. It was, therefore, not a necessary component of these cognitive processes; and we believe an examination of the experiences of everyday life will justify extension of this contention to recognitions in general. The recognition of a pleasing object is a pleasantly toned experience; the recognition of a disagreeable object is often an experience essentially unpleasant. There is one case in which the latter does not hold, the case where the ability to identify the object chances to be of prime importance. In such a case the consciousness may be dominantly pleasant; but, even here, the affective toning need not be a component of the recognition but rather it may color the mental state immediately succeeding that recognition,—a state of awareness of having correctly performed a given task.

The experimental results show that affective toning is absent in so large a number of cases, in each of the levels of familiarization, that it seems necessary to assume that feeling-tone bears no essential relation to recognition, in any of its stages.

c. *Consciousness of self.* The doctrine that consciousness of self is always present in recognition has long appeared in the writings of psychologists.²⁴ The term ‘consciousness of self’ is an ambiguous one; and there is apparently no agreement as to the exact nature of such a consciousness. Titchener (57, 544) describes the consciousness of self as ‘the particular combination of talent, temperament and character,—the intellectual, emotive and active constitution,—that makes up the individual mind.’ The self-experience has “certain fairly constant constituents: organic sensations, a visual perception or idea of the body, and verbal ideas of ‘I’ and ‘my.’”

Calkins, who believes that consciousness of self constitutes the background of all mental experiences, conceives the ‘self’ consciousness as a reality “immediately experienced as possessed of at least four fundamental characters” (46, 3). These characters are: relative persistence, complexity, uniqueness and relatedness.

²³ In some special cases, the affective toning aroused by the stimulus was attended to and made a criterion of identification. (*Cf.* observer V., pp. 364 f.) This is, of course, in no way incompatible with our contention that affective toning is not an essential component of the act of recognizing, for in such cases pleasantness was as much a characteristic feature of the experience examined as was the form of a Della Robbia letter, or the rhythm of a melody.

²⁴ Among others: James Mill, 62, I. 329-339; Claparède, 59, 78-89; Katzaroff, 55, 78; Calkins, 46, 130.

If one adopts Titchener's description of the consciousness of self, there is certainly no warrant to be found in the results of our experiments, for making such a consciousness an essential component of recognition. A study of all the recognitions reported in our experiments yields a remarkably small percentage of cases in which the observer was aware of self, during the cognitive act. In the entire visual series, for example, *W.* was aware of 'self' in five out of seventy-three recognitions; *Fn.* described two such cases in seventy experiences; *Fs.* one out of eighty; and *F.* none at all in his fifty cases. A similar condition is apparent in the introspections on the other kinds of experimental material used.

If, on the other hand, Calkins' conception of the 'self' experience is adopted, the evidence is not quite so unequivocal. *Fn.*, for example, stated plainly that he believes that he is 'always more or less dimly aware of himself as the acting subject' in all his mental experiences. If this be the case, however, the consciousness of self is not a distinctive mark of his recognitions *per se*, but a component of all his mental activity. Moreover, the other eight observers not only did not find the 'self' a constant component, but were even convinced that it was relatively rare in their cognitive experiences.

d. *Summary.* An analysis of the data yielded by some fifteen hundred introspections upon recognition justifies a number of conclusions concerning the sensory components of the act of recognizing:

1. Sensory elements are invariably present. Imageless recognitions are not unusual in the experience of our observers; indeed, reproduced imagery is the exception rather than the rule in the recognizing of very familiar stimuli. But sensationless recognitions,—cognitive processes devoid of kinesthesia or organic sensations, were never experienced by our observers.

2. Three well-marked stages in which the sensory content differs not only in quantity and duration but often in quality as well, make their appearance in the introspective accounts of each of our observers during his progressive familiarization with a given stimulus. These stages may be called the initial, the intermediate and the final stages.

3. In the initial stage, where recognition of slightly familiar objects takes place, the sensory content is rich and varied. The sort of imagery chiefly employed, seems to be that favored in the imaginal type of the observer, no matter what the

modality of the stimulus recognized, *i. e.*, whether it be visual, auditory, tactual or olfactory.

4. The intermediate stage is characterized by a sensory content which is less full and less varied,—the imagery of the initial stage tending to telescope, to lose detail, to alter in various particulars, or even to disappear.²⁵

5. In the final or mechanized stage the sensory content is exceedingly attenuated. Imagery is often entirely lacking, though motor or organic constituents never fail to appear. When imagery is present, it tends to be of the modality of the stimulus recognized in a greater percentage of cases than is found in the initial recognitions.

6. Affective toning is not an essential component of the act of recognizing, at any of its stages.

7. Awareness of 'self' is not a necessary component of recognition.

D. Non-recognition

a. *Introspections and interpretations.* Descriptions of experiences where stimuli which had formerly been presented were believed to be new, shed much light on the problem of recognition. Many cases of this sort were described by our observers. A few typical cases, selected from different series of the experiment, will be quoted and briefly discussed.

After his first presentation of the Bulfinch type of learning, the letter 'B' was presented to Fn. for recognition.

Fn., Bulfinch 'B,' 3.6 sec. "New. I never saw that letter. I did a great deal of thinking here. My perception of it was very clear, but I just attended to a little part of it at a time. My visual schema of five places came up, but the places in it did not seem stable; it seemed to make no difference whether they were at one spot or another. I finally tried to call up images of all the 'B's' and place each in its proper place in the schema. I found I could not get clear images of them and I gave it up. It seems absolutely new."

The schema of which *Fn.* here speaks has already been described (p. 351); and a reference to his descriptions of recognitions of Bulfinch will show the prominent part which it played in his familiarity with this type. In the experience quoted above, *Fn.*'s attention did not behave as it usually did in his encounters with known letters. First of all, instead of being directed to a characteristic feature or group of features,

²⁵ This intermediate stage may manifest numerous levels. The number and the constituents of these levels seem to depend upon a multiplicity of factors, such as: individual differences, complexity of material, length of interval between exposures, etc.

he found that his attention wandered over the letter, examining it bit by bit. Next, on the appearance of his schema, instead of attending to a particular part of it as was the case when he experienced familiarity with the stimulus, he found it all confused and apparently equally unimportant in all its parts. Finally, instead of passing from percept to habitual and appropriate reactions, he was aware of much interpolated mental activity and continued strain.

One of *V.*'s experiences, in which she failed to recognize a familiar odor, is instructive. In learning the perfume called Coast Violet, she had immediately associated the odor and its name with clear visual imagery of pale violets growing on flat sand dunes,—an image directly traceable to experiences at her favorite coast resort. This was accompanied by very pleasant affective toning, and supplemented by a frequent repetition of the words 'Coast Violet' in vocal-motor imagery. Her subsequent recognitions of this odor made use of the same experiences; their number decreased rapidly, but no new activities or processes were present. Two weeks after her first learning of the odor, though she had recognized it as familiar in the meantime, she reported the following experience.

Observer *V.*, Coast Violet, 21 sec. "I think I've never smelled this before. I tried, excitedly, to place it in a former sitting,—this in a strong contraction of muscles as though to face in the direction of the room in which we sat last time. This faded out of consciousness and I leaned forward in an attempt to get more of the peculiar quality of the odor. Pleasant affective toning welled up, and vocal-motor imagery 'perfume.' Then a visual image of a bright bed of flowers,—tulips, I think. Then my attention seemed entirely taken up with an auditory image of your voice saying 'introspect.' There was no familiarity in the whole process."

Here, from the very inception of the experience, a new set of images and activities ran their course, and no 'feeling' of familiarity resulted, or, as I should prefer to put it, this experience of a new sequence of mental events was the experience of unfamiliarity.

Bd.'s introspections in the olfactory experiment furnish several cases of absolute non-recognition of odors which had been presented before, or even partially learned previously.

Observer *Bd.*, Coast Violet, 10 sec. "No familiarity. While I was smelling it, two or three names occurred in vocal-motor terms, but in very fleeting form: 'Violet, Rose.' They slipped right through consciousness: there was no tendency to accept one rather than another,—indeed, none seemed appropriate."

In cases where *Bd.* recognized this odor, his experience followed the same sequence which occurred in his learning experiences, *i. e.*, awareness of odor quality, organic sensation of relaxation, together with the name 'Coast Violet' in vocal-motor terms, and immediate shift of attention.

A typical description of *B.*'s recognitions of the Rigoletto selection has already been quoted (p. 340). The following is a case where this air seemed quite new and unfamiliar up to a certain point in the experience,—namely, the point at which the sequence of processes formerly experienced with this air enters consciousness.

Observer *B.*, Rigoletto, 15 sec. "It was some time before I realized that that was a familiar air. I kept trying to place it in the experiment and make it seem familiar,—this in terms of calling up former sittings in this room, imagery of you, of myself and of some auditory snatches of airs. But the whole thing was confused. I felt tense and puzzled. Then suddenly I fell into the rhythm and the air began immediately to seem familiar."

b. Confirmatory evidence. To our own cases, already quoted, may be added an exceedingly interesting case recently published by Borel (43). A French medical student of his acquaintance described to Borel two experiences of '*jamais vu*', each of which occurred as he was walking down a street which he had traversed many times. On these two occasions, however, he was walking in a direction opposite to that usually taken. He experienced, each time, a feeling of utter unfamiliarity, though in neither case was there any strain, anxiety or unpleasantness. Borel believes that the phenomena were due to the reversal of the order in which the perceptions were experienced. He inclines to Bergson's view of recognition as an awareness of an adopted motor response (42, p. 111) and maintains that it is difficult to change the order of such responses. Therefore, he concludes, when series of perceptions are aroused in their usual order, a feeling of recognition results, but if perceptions are aroused in an unusual order, non-recognition ensues.

But non-recognition can not be dependent entirely on the order in which perceptions come to consciousness, else every one walking down a familiar street in reverse direction would repeat the experience of the French medical student. Moreover, in our own cases of non-recognition the perceptions often arrived in normal sequence, but the subsequent mental processes did not. Borel's idea of the necessity of the accustomed sequence of mental activities is in agreement with our own; but we would not confine those activities to the perceptions of the objects recognized. The sequence which our data seem

to us to establish as essential to recognition proceeds, in the most nearly mechanized cases which still have the awareness of familiarity, from *Aufgabe* to clear perception, thence to appropriate reaction, culminating in a shift of attention. Intermediate processes of associating, comparing, and the like, occur in the case of less familiar material.

This envisagement of recognition as an awareness of such a sequence of events is well suited to explain the experience of unfamiliarity reported by Severance and Washburn (69) where the observers' attention was concentrated upon a given object until its familiarity vanished. The normal sequence of mental events was not permitted to run its course.

E. False Recognitions.

During the course of these experiments, there occurred, with each observer, several cases in which 'new' stimuli were falsely recognized as 'old.' We shall quote a number of typical cases and discuss what seems to be the significant features of these paramnesias.

Observer *Fs.*, *Quelques Fleurs*. (New), 2.4 sec. "That's violet. Almost instantly I was aware that that was a fragrant odor. My attention singled out the unmistakable violet character. The vocal-motor image 'vi' occurred and then I withdrew the bottle and said 'That's violet.'"

Fs. gave every evidence here of being certain of her identification. The odor seemed entirely familiar, though it was, as a matter of fact, quite new to her. Soon afterwards she learned to recognize this odor easily and unfailingly; and on a later occasion she stated that the odor was not at all like violet in quality and unlike any other she had ever smelled. Her whole procedure, however, in the experience quoted above, was identical with that characterizing her usual experience with the violet odor. It consisted in a preparedness to recognize (evinced in a tense attitude and an expectant expression) and a clear presence in consciousness of a perfume quality, followed by the uninhibited vocal-motor image of a known perfume's name, which was then actually spoken aloud with conviction.

Observer *F.*, *Hansel and Gretel*. (New), 20 sec. "At first I thought it was going to be familiar. I began humming along with it and 'Meyerbeer's Prophet' came to mind in auditory imagery. But instead of accepting this, I found myself repeating it with a questioning accent. My humming had ceased, my tension increased, and all the familiarity was gone."

Here again, we find the experience of familiarity to be an habitual behavior of attention. *F.* finds that he has been

experiencing all the events which usually compose his total reaction to a known air, and the air seems familiar. But when, instead of experiencing the usual reaction and then turning from the experience to attend to something else, he finds his attention lingering on it, repeating part of it, hesitatingly, then all sense of familiarity departs.

Fs. had a similar experience on hearing, for the first time, the selection from Humperdinck's opera.

Observer *Fs.*, Hansel and Gretel. (New), 30 sec. "I was sure that was a familiar one at first. I really recognized it as *Loch Lomond*. The experience was like this. I was prepared for an old air,—this in terms of adaptation for listening, with my hand poised above the reaction-key. When the music began, I started to hum. My vocal apparatus formed itself to say 'Loch' and I felt my finger innervated to give the tap. But the movement was inhibited, apparently through the shift of my attention to the characteristics of the music again. The air grew very clear and insistent; I ceased humming and became very tense. Now I was very actively noting the music and experiencing recalls of other bits you have played to me here. No name for this came up, and I finally gave you the signal-tap. I'm still keyed up over that. What in the world is it?"

In the first part of this experience is a typical example of false recognition. The auditory stimulus, flooding into a consciousness dominated by a recognition-*Aufgabe*, was at first followed by the course of mental events characteristic of the experience of familiarity: the singling out of a feature to be noted; bodily adjustment to the stimulus, which took the form of voiceless humming; partially imaged pronunciation of a name; and an initiated reaction on the signal key. The sequence was identical with that present in correct recognition.

The experiments with the New York Point alphabet furnished several instances of false recognition. *W.* describes an experience in which 'i,' which he had never before examined, was recognized as 'a,' which was very familiar to him.

Observer *W.*, New York Point 'i.' (New), 5 sec. "As soon as I perceived that there were two dots, the tactile impression became non-focal, and I attended only to a very clear visual image of the dots; their vertical position seemed very prominent. With the appearance of that visual image, there was a very definite feeling of familiarity; no memory images accompanied it,—the familiarity seemed rather to be in my clear perception of the symbol itself. I took my fingers off the dots and said, 'That's "a."'"

W.'s criterion for recognizing the 'a' symbol (which consists of two horizontal burrs), was a visual image of two dots. He always reported that he first had an awareness that there were *two* dots, and then a consciousness of the direction in

which they lay. On being presented for the first time with the 'i' symbol, which consists of two burrs arranged one above the other, his clear visual image of the two dots, an awareness of direction succeeded by the usual reaction to these cues, constituted entire familiarity which culminated in the pronouncing of the name 'a.' Had the awareness of the particular direction been prominent enough in consciousness to inhibit the usual reaction to the 'a' stimulus, the entire color of the consciousness would doubtless have been changed, and uncertainty, if not an actual experience of unfamiliarity would have resulted. Cases of non-recognition of old stimuli present pictures of just such occurrences (pp. 375ff.).

Examples could be multiplied. The significance of these cases of paramnesia is that the mental experience involved in each experience is one which moves in a sequence identical with that present in cases of correct recognition: the same significant detail or details are noted; the same associations (if any) are aroused; the same bodily reaction follows after a perceptible time; the same shift of attention to other matters completes the experience.

Such an interpretation of the phenomena of '*déjà vu*' would seem to explain it better than does that of Lalande (67) who assumes that cases of this sort occur with stimuli of which there really has been a double perception, the first being unconscious; when the two become integrated a feeling of familiarity subsequently arises. This account of 'false recognition' really explains it out of existence. There are doubtless many cases of apparently false recognition which could be accounted for in some such way. But many others do not seem to admit of such an explanation. The cases quoted from our own experiments can not be so explained, for our experimental conditions and our introspective evidence rule out the possibility of such a double perception.

Bourdon (15) points out that it is exceedingly difficult to find a case of a wholly new experience in the consciousness of the adult; and he holds that in all cases of '*déjà vu*', the stimulus which is recognized resembles one which was formerly experienced. He explains this by invoking a 'feeling of familiarity' (due to facilitation of perception) which attaches to the recognized object. But we may accept Bourdon's hypothesis without agreeing with his explanation. Even if all stimuli which seem familiar do resemble others which have belonged to the observer's experience, the important fact remains, that the mental events attending the recognition of these stimuli form a sequence identical with that which char-

acterizes the cognitive experience for stimuli of that modality.

3. Conclusion

Our investigation has shown that the experience of familiarity is essentially a motile, flowing consciousness,—the product of a peculiar sequence of clearnesses, durations and adjustments. The apparently simple experience of recognition proves to be a complex process whose degree of complexity varies with the degree of familiarity of the stimulus.

Various levels of cognitive experience may be differentiated: An '*initial*' level where the stimulus is but slightly familiar and where the (incipient) recognition is a peculiarly haunting and persistent experience. This level is characterized by a wealth of sensory components and by a keenly active attention, attention usually being busied with searching for a name or for other associations which 'fit' the situation; the consciousness of 'fitness' is essentially a behavior of attention,—when the 'fitting' association appears the search is abandoned and attention shifts elsewhere. The '*intermediate*' level differs from the initial level in that it is briefer and much less rich in sensory content. In the '*final*' stage the process is very much syncopated; imagery is often wholly lacking here, an appropriate reaction frequently ensuing upon the perception of the stimulus.

Imagery plays a progressively less important rôle during the life history of a complete familiarization; affective processes and the consciousness of self appear so irregularly that they are to be regarded as entirely fortuitous.

There is a functional component, however, which is constant throughout the various levels; and one is impelled to conclude that it constitutes the essence of the cognitive experience. This functional complex consists in an on-going consciousness of activities, of pauses, of adjustments and shifts of attention. In other words, recognition is a sequential experience which, although highly unified for consciousness, may be analyzed into components; and its *sine qua non* is an orderly procession of mental events,—from clear percept through appropriate reaction to attention-shift,—under the direction of the *Aufgabe* or the *Einstellung* to recognize.

IV. APPENDIX

A. A Brief Summary of Theories

The theories which have been advanced to explain the nature of the process of recognition fall into two groups, which may be called

theories of underived and theories of derived awareness. In the bibliography which is appended, representative writers on recognition are classified according to the viewpoint which the present author understands them to champion. Theories of the former type describe the consciousness of 'known,'—one's awareness that a given experience is not new,—as a mental datum which is immediately given; this datum is conceived to be a quality which is an inherent part of the perception of a repeated stimulus, irreducible and incapable of further description. Within this type of theory one finds two sub-types,—the 'intellectual' and the 'affective.' The exponents of the former view envisage the consciousness of 'known' as a purely intellectual, non-emotional datum, while for the exponents of the latter view it is dominantly or exclusively affective.

An interesting theory of the underived type is that championed by Washburn (5), who considers the feeling of familiarity to be the psychical accompaniment of the weak excitation of groups of cerebral neurones, whose activity was associated with that of the group excited by the familiar stimulus when it was formerly experienced. If these associated groups are strongly excited, so that images are aroused, she believes that perception and not recognition ensues. But is the recognized object then not perceived? And must an experience of familiarity precede every perception? The fact that the arousal of many associated images does not destroy but often actually intensifies the awareness of familiarity tells against this theory.

The advocates of the affective theory of 'derived awareness' maintain that recognition is an experience which is primarily emotional, a genuine 'feeling' of familiarity which attaches to the perception of known objects. Introspectionists maintain that an appeal to the known results of psychological analyses made in numerous studies suffices to overthrow all *sui generis* theories of recognition,—the 'feeling' of familiarity is analyzable.

The second group embraces those theories which conceive the consciousness of familiarity to be derived from certain elementary processes, sensory or affective, or both. These theories, like those of the *sui generis* or 'underived' group, may be divided into two sub-groups according to the emphasis placed by their sponsors upon the intellectual or upon the affective elements involved. At least six well-differentiated types of theory can be distinguished within the intellectual group of these theories. They may be characterized briefly as follows:

1. The *facilitation* theory assumes that recognition is due to the augmented ease with which a recurrent content comes to consciousness. This theory is usually furnished with an alleged physiological basis, the assumption being that, in consequence of practice, cerebral activity becomes more easily excitable and brain paths become more readily conductive.

Two objections may be urged against the facilitation theory. First, it helps us not at all on the side of consciousness. While it seems probable that brain processes are facilitated as they are repeated, we are chiefly interested in determining what is present to consciousness during the various stages of this habituation. Second, the most facile processes,—the processes which accompany those daily, habitual experiences to which our reactions are all but automatized,—do not bring with them the peculiar experience of familiarity.

2. The *association* theory makes recognition depend upon the arousal of images which on a former occasion have been associated with the

object recognized.²⁶ There are two well-marked types of association theory: *a.* the *comparison* theory, which supposes that when a stimulus is recognized, a comparison, conscious or unconscious, has taken place between the perception and revived imagery of former experience; *b.* the *fusion* theory, which bases recognition on an amalgamation of a present percept with a simultaneously aroused image of like nature. The *fusion* theory finds a variant in Semon's assumption (38) that the perception of any known object arouses a memorial trace of its former impression, the perception meanwhile having its own intensity peculiarly augmented thereby.

In criticism of the association theory, one may appeal to our experimental results, which furnish hundreds of instances of recognitions in which no associated imagery was aroused. The 'fusion' variant of this theory is more difficult to ignore, since it does not require that the aroused imagery shall become conscious. We should prefer to regard an unconscious process as a physiological one; nor can we see how such a concept of 'fusion' aids in the description of the *consciousness* of familiarity. The *fusion* theory, moreover, seems inadequate to account for experiences of false recognition, in which case there is no residuum of an identical past experience to be incited to arousal.

3. The *evocation* theory rests on the assumption of separate brain centers for receiving and for storing peripherally aroused impressions, and on the further assumption that recognition depends upon excitations which are centrally, rather than peripherally aroused. Certain advocates²⁷ of this theory refer psychic blindness to the absence of such centrifugal excitations.

The *evocation* theory, like that of facilitation, is of no aid in envisaging the conscious components of recognition. Even if one should accept the theory of separate centers as an explanation of the brain processes involved, one may urge against it the two-fold objection, that central excitations of associated centers must be a constant phenomenon of waking life, yet we are not continuously in the flush of familiarity; and that such excitations should be most numerous and intensive (through facilitation) in the case of objects which we hourly encounter. Yet it is not with these objects that we experience intensively the unique consciousness which is commonly called the feeling of familiarity.

4. The *adjustment* theory explains recognition as an awareness of a bodily attitude which is appropriate to an organized motor response. This theory is more nearly in accord with our findings than any one of those previously discussed; but it is not, we believe, entirely adequate. As Katzaroff has pointed out, motor responses become well organized only by habit; and it is just in cases of habitual stimuli that the experience of familiarity is lacking (55, p. 18). Motor adjustment is rather the climax of the experience of familiarity,—an essential component of recognizing; it is not the complete sum-total of the familiarity consciousness.

5. The *relation* theory attributes the 'feeling of known' to an awareness of relation. This awareness of relation is conceived to be a unique mental datum,—a datum which is a product of past experience, and which is dominantly of an intellectual sort. Calkins (46,

²⁶ This theory is more fully discussed in connection with the Lehmann-Höffding controversy (pp. 314f.).

²⁷ Cf. Munk (39) and Wilbrand (41).

pp. 130, 131) believes that it consists in an awareness of relation between the object of recognition and the consciousness of 'self' as persistent. Neither our experimental findings nor the writer's own introspections support the view of an 'awareness of self as persistent,' nor was such an awareness an essential component of the recognitions described by our observers. If we understand Ach (45, p. 263) his experience of 'relation' is an intellectual datum, not further reducible, containing neither sensory nor affective elements. Our recognitions sometimes contained affective components and they always included sensory elements.

6. *Mental Attitudes.* This type of theory attributes the process of recognizing to the peculiar mental adjustment which accompanies the perception of a known stimulus. Betz' (47) phrase, the 'adjustment (*Einstellung*) which goes best' seems, however, rather to be an attempt to describe the mental experience at the moment when a sense of familiarity has culminated in an identification. Clarke (48) believes that recognition is a conscious attitude, but maintains, on the basis of experimental evidence, that it can be resolved into various elements, sensory and affective.

The terms attitude and *Einstellung* seem to refer to a given moment of consciousness,—a relatively static experience. We are convinced that recognition,—and its unique and essential component, the awareness of familiarity,—is an experience whose essence consists in the fact that it is in motion, that it is extended in time, and that it consists in habitual sequences of attention.

Two groups of theories may be distinguished among those which we have called the affective theories of the 'derived' group. One of these emphasizes the consciousness of self as a basic component of the 'feeling of familiarity,' while the other regards the act of recognition as a unique affective quality which has come to be attached to the re-experiencing of any mental process. If our data have yielded conclusions which are applicable to all recognitions, neither of these theories has any factual basis.

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